

CITY GOAL

results
minneapolis

Healthy Lakes, Rivers and Streams

June 22, 2016



What is this program?

City Goal Results Minneapolis roundtables are focused on answering the question “Are we there yet?” by reporting progress on our community indicators. These reports are analytical in nature and focused on making data-driven connections across multiple sectors. Creating City Goal Results Minneapolis reports requires input from multiple departments and, in many cases, external participants. The goal of this initiative is to reflect the realities experienced in Minneapolis communities. The two major objectives of the report and roundtable are 1) to have a new and different understanding of the indicators and 2) to think differently about solutions.

Why impaired water bodies?

Water body impairments are an important long-term measure of water quality. Impaired water bodies are those that do not meet state water quality standards for various pollutants. A water body can have impairments in more than one category.

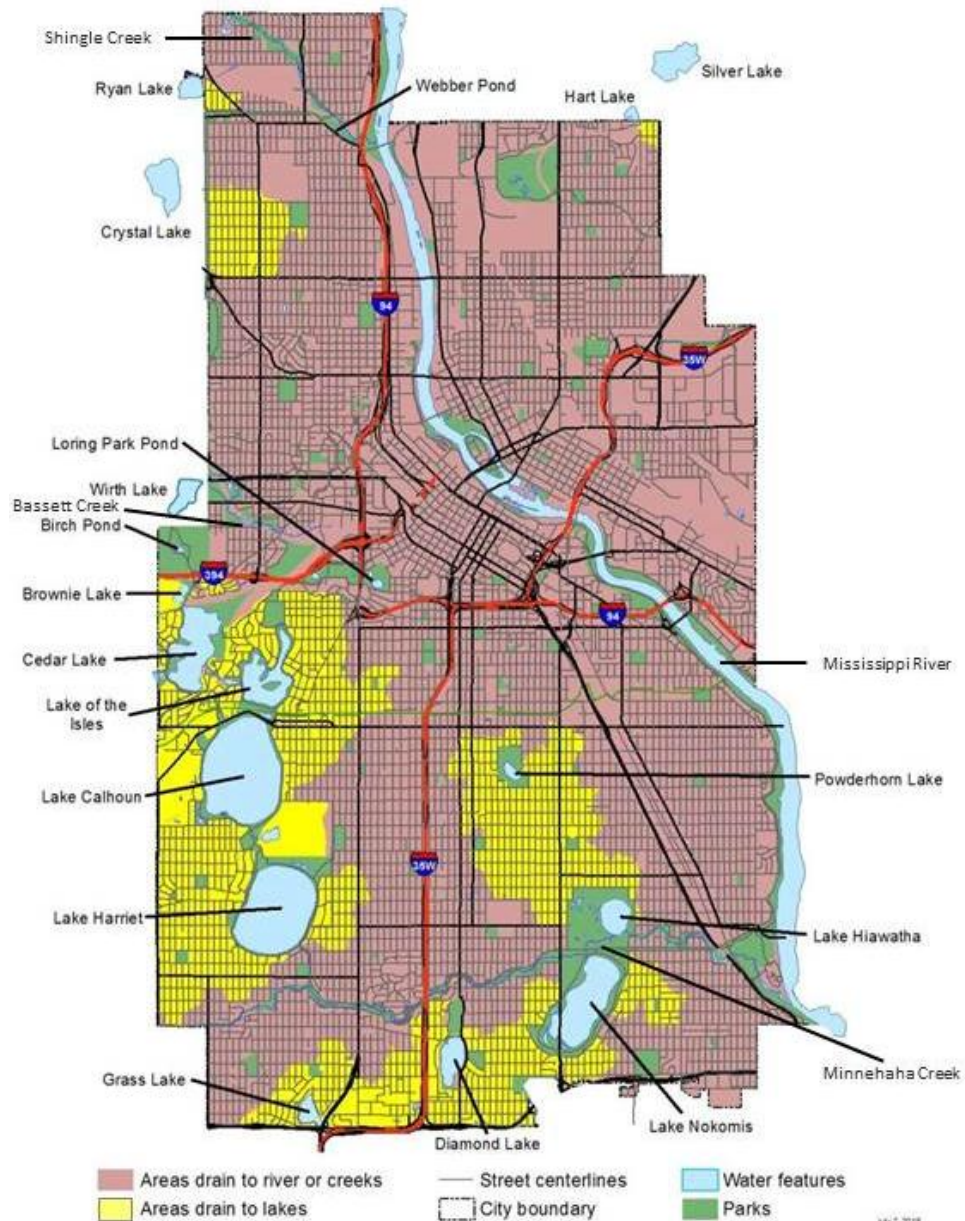
Why the LAURI?

The Lake Aesthetic and User Recreation Index (LAURI) is an educational tool used by the Minneapolis Park & Recreation Board to evaluate and focus on improvements for public health, water quality, habitat quality, recreational access and aesthetic considerations for nine lakes in Minneapolis.

This report was created in collaboration with:

- City of Minneapolis: Public Works –Surface Water and Sewers Division
- Minneapolis Park & Recreation Board: Environmental Management

Land areas draining to local water bodies



Understanding the issues

This report was developed to highlight past challenges and how much progress has been made, to describe current conditions and challenges, and to frame a discussion of ongoing strategies and efforts needed to support healthy, high-quality Minneapolis waterways into the future.

- How we measure water quality, and how we identify and target pollutant sources, is important.
- Water quality is influenced by many factors inside and outside Minneapolis.
- The City and Park Board work with residents and businesses to educate them on how their actions affect water quality.
- The City and Park Board work with governmental and other partners to carry out research, projects and programs that will cost-effectively improve conditions.
- Where the City and Park Board cannot influence or control sources of water pollution, they do their best to cost-effectively manage the impacts.

The state of our water bodies can be analyzed using a past, present and future lens.

- This report describes the past, present and future of water quality: past problems and the progress Minneapolis has made to improve its water quality, the current state of our waters, and future water quality challenges.

Past progress has improved water quality.

- When we focus and take action to reduce water pollution, it can work. Four examples in this report illustrate infrastructure investments and policy changes that have improved water quality.

Today, many sources of degradation and pollution impact the quality of Minneapolis water bodies.

- Some pollutants are a legacy of past land uses or systems, but persist in the environment.
- Some pollutants that continue to be generated by how we live today are within the City's regulatory control, and some are not.
- Some pollution sources are outside the geographic boundaries of the City.

Additional future improvements in water quality in the future will require action to be taken by the City, its businesses and its residents.

- Significant challenges remain. Additional pollutants may rise in importance and climate change may pose new or tougher problems for aquatic viability. The City needs to plan for, and continue to address, future water quality concerns.

Questions for discussion

- How do we address the long-term nature of water quality protection in the context of one-year budgetary commitments and 4-year election cycles?
- How do we balance some of the tradeoffs we have to make between conflicting priorities, like:
 - The importance of public safety on icy pavement, and the need to protect water quality from road salt?
 - The importance of recreation and the impacts that recreation has on our water, like erosion, trash and invasive species (are we loving our lakes to death)?
- Because water quality does not depend only on Minneapolis actions, how can we effectively collaborate on a regional, statewide and national level?
- How can we raise awareness of these issues so that residents and staff know how to protect our water?

healthy lakes, rivers and streams

FRAMEWORK FOR ANALYSIS

Minneapolis residents take pride in the health of our lakes, creeks and the Mississippi River. These water bodies are iconic places that provide recreational opportunities, scenic beauty, and habitat value. The framework on the following page is one way to illustrate how we approach thinking about the health of our lakes, rivers and streams. This framework also helps to show where the City can and cannot influence the quality of our water.

Framework: Healthy lakes, rivers and streams

The framework below is one way to think about factors that influence our lakes, river and streams, the impacts of these factors, the way the health of our water bodies is measured, and opportunities to take action.

Water quality is influenced by many sources inside and outside Minneapolis. It is increasingly clear that the way we measure water quality and what types of pollution we measure are important. We can control or influence some sources of water pollution but not others. Where we cannot influence or control sources of water pollution, we do our best to manage the impacts.

1. Sources

Aquatic invasive species
Pollutants in stormwater runoff from:

- Soil erosion
- Construction sites
- Industrial sites
- Vehicles
- Road salts
- Spills, dumping
- Grass clippings, leaves, trash left on the street
- Animal waste
- Contaminated soils/ groundwater
- Coal plants
- Coal tar-based sealants

These sources impact the health of our water bodies and the ways that City residents and visitors interact with the water

2. Impacts on lakes, rivers + streams

*If the sources are regulated by the City, the **sources** are managed*

*If City cannot control sources, **impacts** are managed*

3. Measurements

State list of impaired water bodies
Lake Aesthetic and User Recreation Index
Ongoing monitoring

The ways we measure the health of our lakes, rivers, and streams influence how we take action

4. Actions

Inspections and enforcement
Policy changes
Education and outreach
Development controls
Structural controls
Comprehensive planning

The ability to take action depends on factors within and outside governmental control

healthy lakes, rivers and streams

INDICATORS

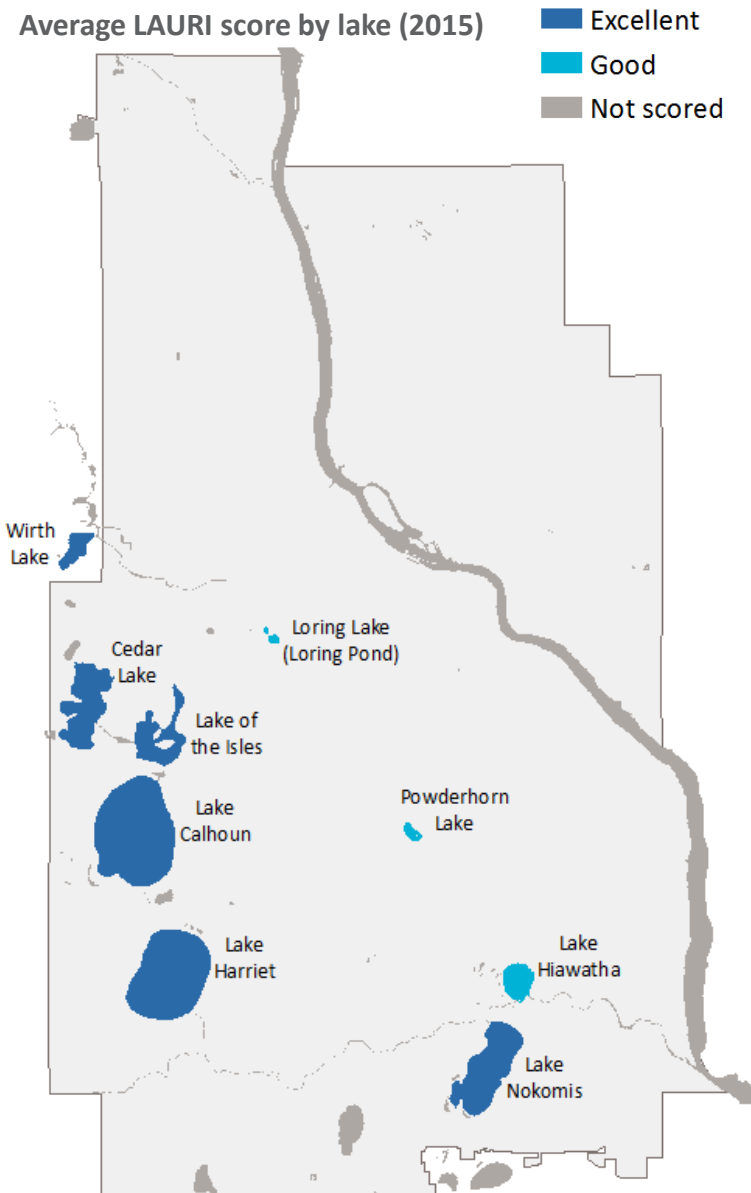
The two indicators explored in this report are the Lake Aesthetic and User Recreational Index (LAURI) and Impaired Water Bodies. The LAURI is a tool developed by the Minneapolis Park and Recreational Board. Impaired Water Bodies are determined by the State of Minnesota to measure and regulate levels of certain pollutants that do not meet state water quality standards. The next two pages contain a summary explanation of each of these indicators.

Indicator: Lake Aesthetic and User Recreation Index (LAURI)

The **Lake Aesthetic and User Recreation Index (LAURI)** is an educational tool used by the Minneapolis Park & Recreation Board to communicate conditions that affect public use of nine Minneapolis lakes. Five separate components are combined to create the LAURI. Individual measurements are explored separately on the following pages. The LAURI has been compiled in its current form since 2010.



Average LAURI score by lake (2015)



Average LAURI score by lake (2015)

Lake	Average LAURI score (2015)
Wirth Lake	9.0 (Excellent)
Lake of the Isles*	8.7 (Excellent)
Lake Harriet	8.6 (Excellent)
Lake Calhoun	8.2 (Excellent)
Cedar Lake	7.7 (Excellent)
Lake Nokomis*	7.3 (Excellent)
Loring Lake (Loring Pond)*	6.3 (Good)
Lake Hiawatha*	5.3 (Good)
Powderhorn Lake*	4.3 (Good)

*Shallow lake. Because water clarity is difficult to measure in shallow lakes, shallow lakes are scored differently for the water clarity component.

Data source: Minneapolis Park & Recreation Board

Indicator: Lake Aesthetic User and Recreation Index

Component 1: Public health

Measure: *E. coli* measured at public swimming beaches

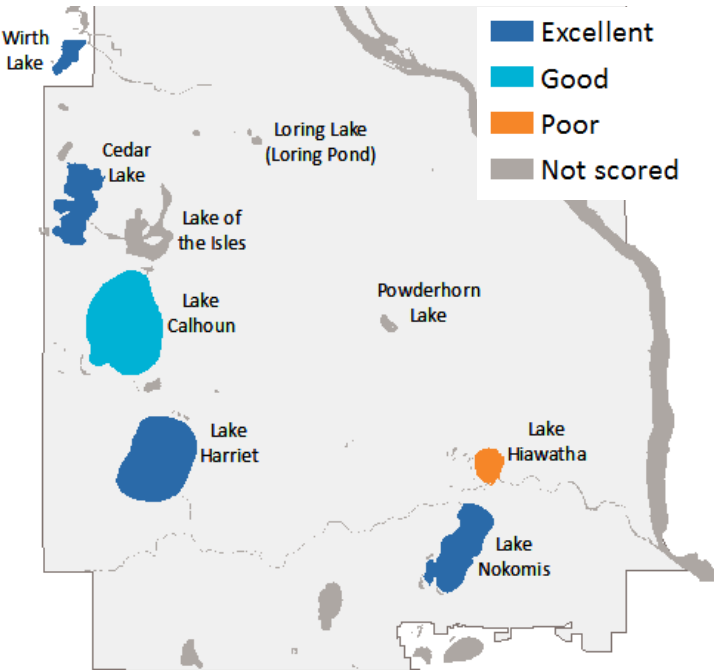
What to know:

- Among all the components of the LAURI, the Public Health index fluctuates the most.
- *E. coli* is monitored weekly during the swimming season, from June through August. This is the time of year when lake water is most likely to be accidentally ingested during recreational activities.
- Data is published on the Park Board website.

Why it’s important:

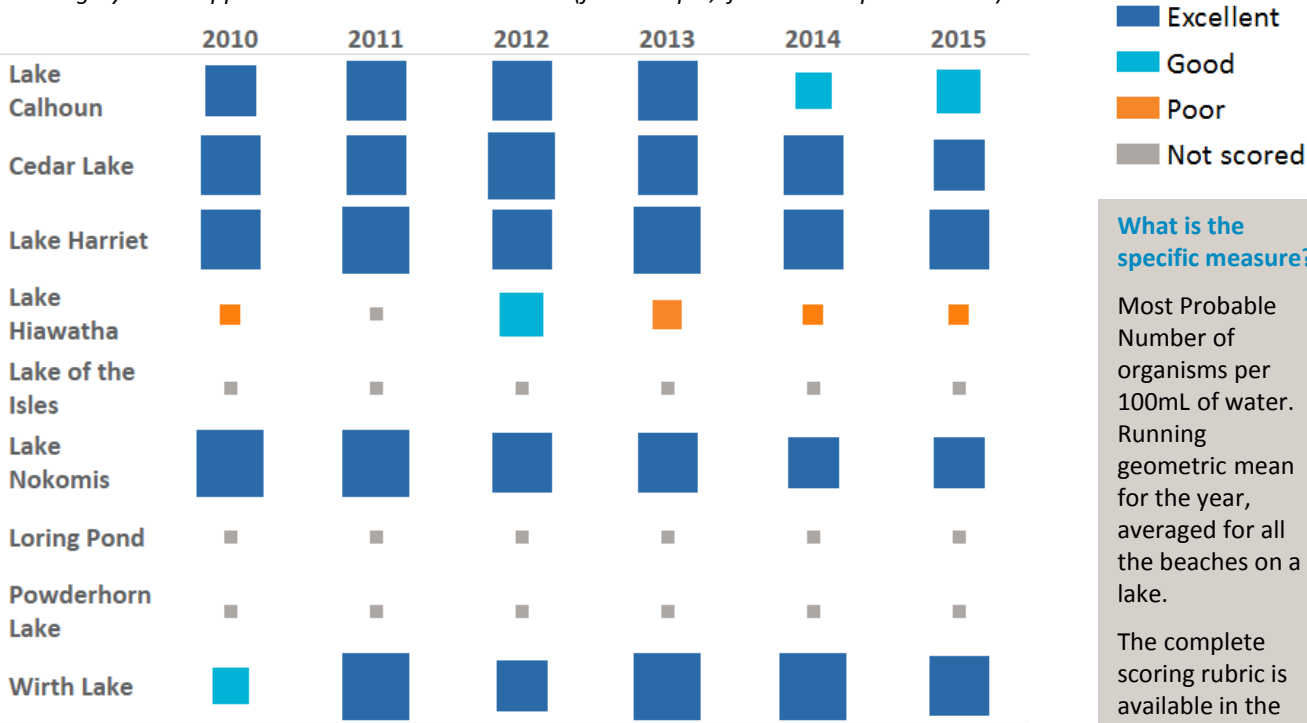
- Most strains of *E. coli* do not cause illness; only a few strains of *E. coli* make people sick. However, high levels of *E. coli* indicate that other pathogenic microorganisms could be present that can make people sick.

Public health score by measured lake (2015)



Public health score by measured lake (2010-2015)

The size of the square corresponds to the score. Larger squares indicate higher scores. Small grey boxes appear where no score is available (for example, if there is no public beach).



Indicator: Lake Aesthetic User and Recreation Index

Component 2: Water quality

Measure: Water clarity

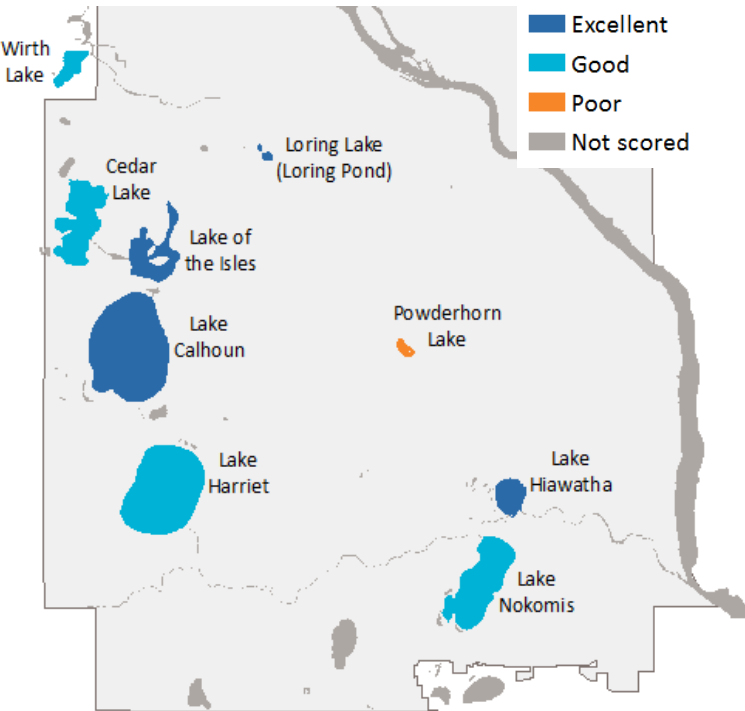
What to know:

- Seasonal fluctuations for this component can be significant, but the annual average changes slowly over time. This is because the physical features of the lake don't (and shouldn't) typically change drastically from year to year.
- The index is created from all the data collected during the growing season (May through September).
- Lakes are separated into deep lakes and shallow lakes (those that are predominantly less than 15 feet deep). Shallow lakes function differently and are therefore measured differently on this component.

Why it's important:

- Water clarity is an indirect measure of suspended matter in the water, often algae in Minneapolis lakes. The clearer the water, the further light can penetrate, resulting in a greater Secchi transparency. Water clarity affects the health and diversity of aquatic life.

Water quality score by measured lake (2015)



Water quality score by measured lake (2010-2015)

The size of the square corresponds to the score. Larger squares indicate higher scores.

		2010	2011	2012	2013	2014	2015
Lake Calhoun	Deep lake	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Cedar Lake	Deep lake	Good	Good	Good	Good	Good	Good
Lake Harriet	Deep lake	Excellent	Excellent	Excellent	Excellent	Good	Good
Lake Hiawatha	Shallow lake	Excellent	Good	Good	Excellent	Excellent	Excellent
Lake of the Isles	Shallow lake	Excellent	Good	Good	Good	Good	Excellent
Loring Pond	Shallow lake	Good	Good	Good	Excellent	Excellent	Excellent
Lake Nokomis	Shallow lake	Good	Good	Good	Good	Excellent	Good
Powderhorn Lake	Shallow lake	Good	Good	Good	Poor	Poor	Poor
Wirth Lake	Deep lake	Good	Good	Good	Good	Good	Good

- Excellent
- Good
- Poor
- Not scored

What is the specific measure?

Average Secchi transparency depth in meters.

The complete scoring rubric is available in the Appendix of this report.

Data source: Minneapolis Park & Recreation Board

Indicator: Lake Aesthetic User and Recreation Index

Component 3: Habitat quality

Measure: Aquatic plant and fish diversity

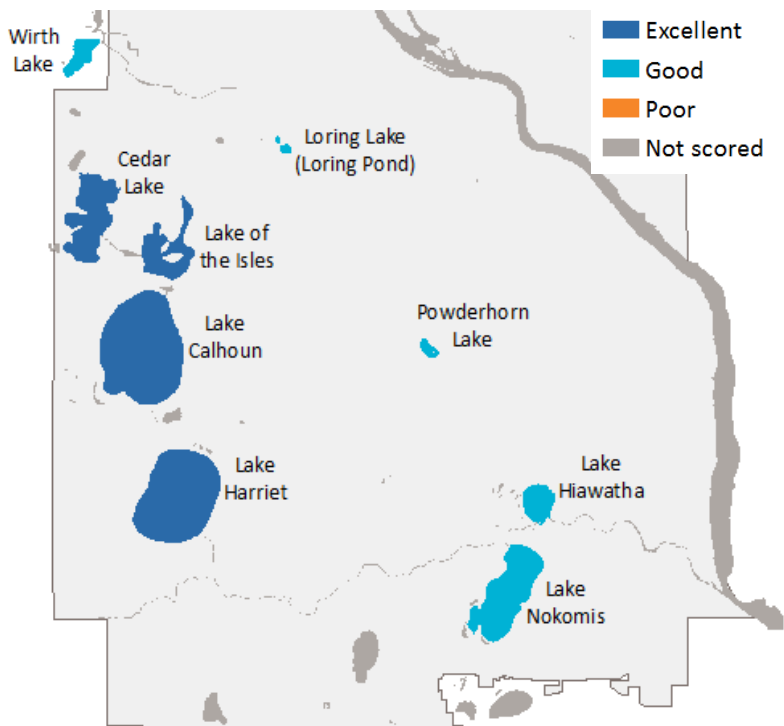
What to know:

- Data comes from plant surveys periodically conducted by the Park Board and from fish surveys conducted by the Minnesota Department of Natural Resources.

Why it’s important:

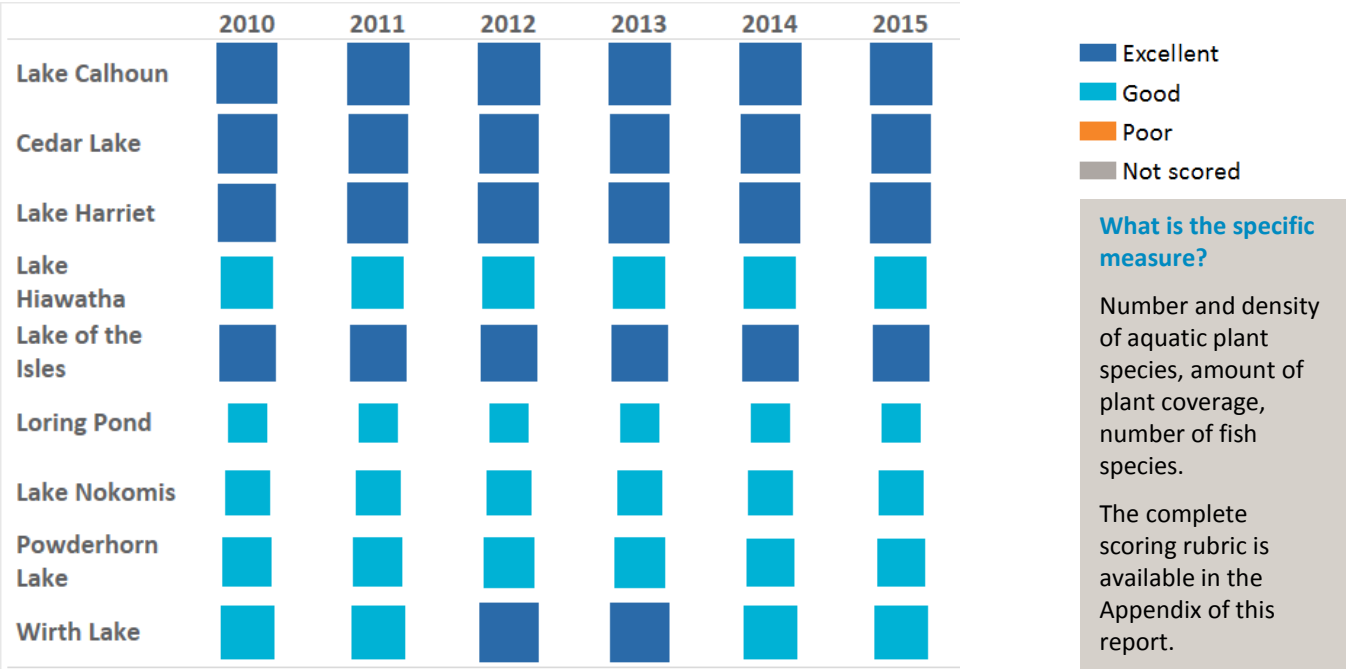
- Habitat provides food and shelter for fish, invertebrate species, waterfowl and other wildlife, and protects shorelines from erosion.

Habitat quality score by measured lake (2015)



Habitat quality index by measured lake (2010-2015)

The size of the square corresponds to the score. Larger squares indicate higher scores.



Data source: Minneapolis Park & Recreation Board

Indicator: Lake Aesthetic User and Recreation Index

Component 4: Recreational access

Measure: Availability and ease of public access

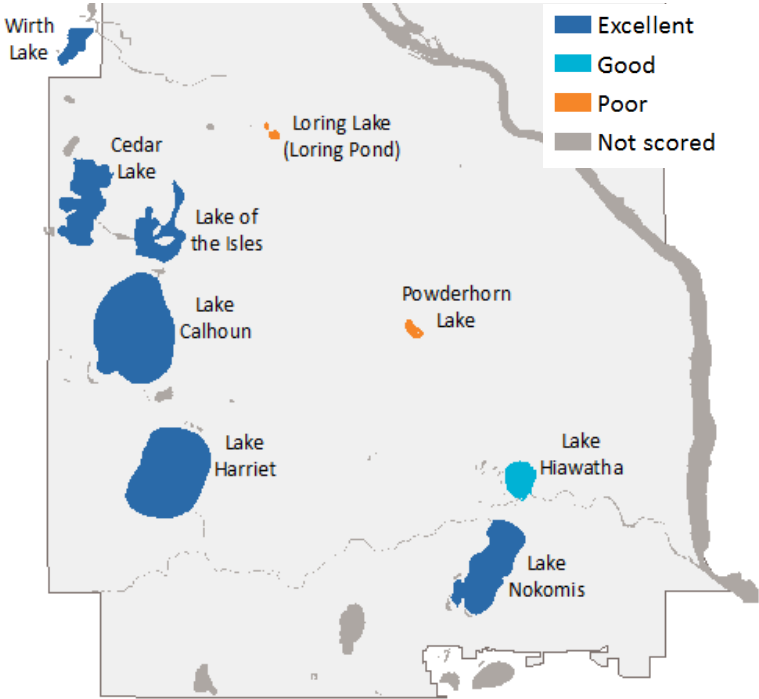
What to know:

- This component changes when infrastructure changes.
- There tends to be little year to year change because infrastructure changes do not happen frequently.
- All lake shoreline in Minneapolis is in public ownership, and many lakes (even those rated poor) have recreational paths along all or a portion of the shoreline.

Why it's important:

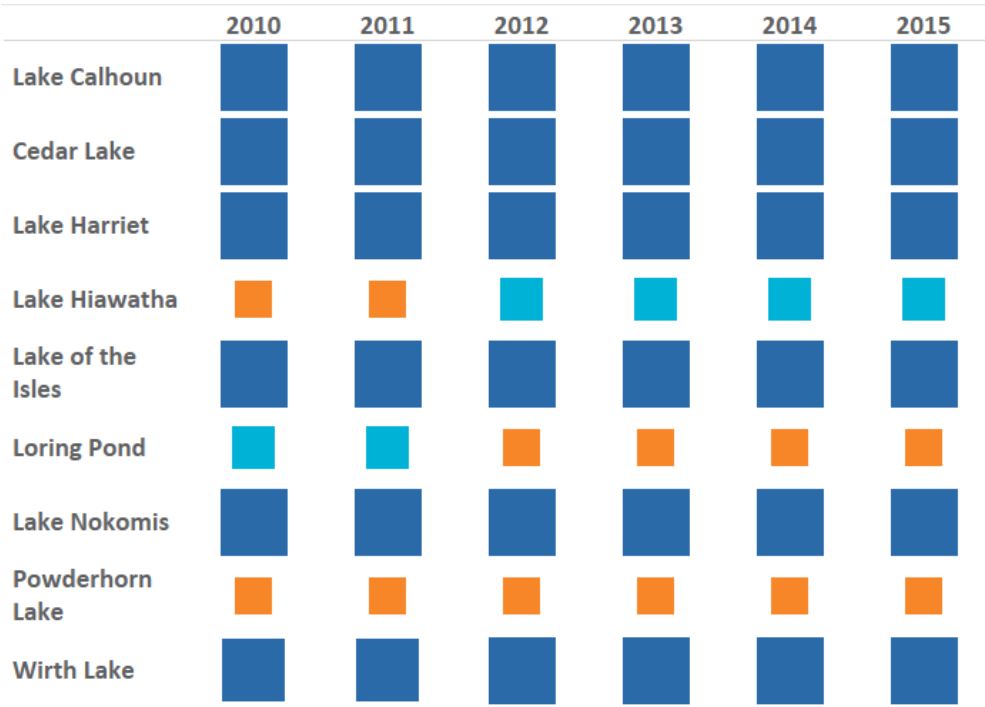
- Public access to our lakes, river and creeks adds to the quality of life for Minneapolis residents and visitors, and contributes to a sense of stewardship for our natural resources.

Recreational access score by measured lake (2015)



Recreational access score by measured lake (2010-2015)

The size of the square corresponds to the score. Larger squares indicate higher scores.



- Excellent
- Good
- Poor
- Not scored

What is the specific measure?

Number of fishing docks, beaches, boat launches, intra-lake connections, canoe racks and rentals, picnic areas, concessions
 Presence or absence of invasive plant growth management

The complete scoring rubric is available in the Appendix of this report.

Data source: Minneapolis Park & Recreation Board

Indicator: Lake Aesthetic User and Recreation Index

Component 5: Aesthetic considerations

Measure: Color and odor of water, trash and debris

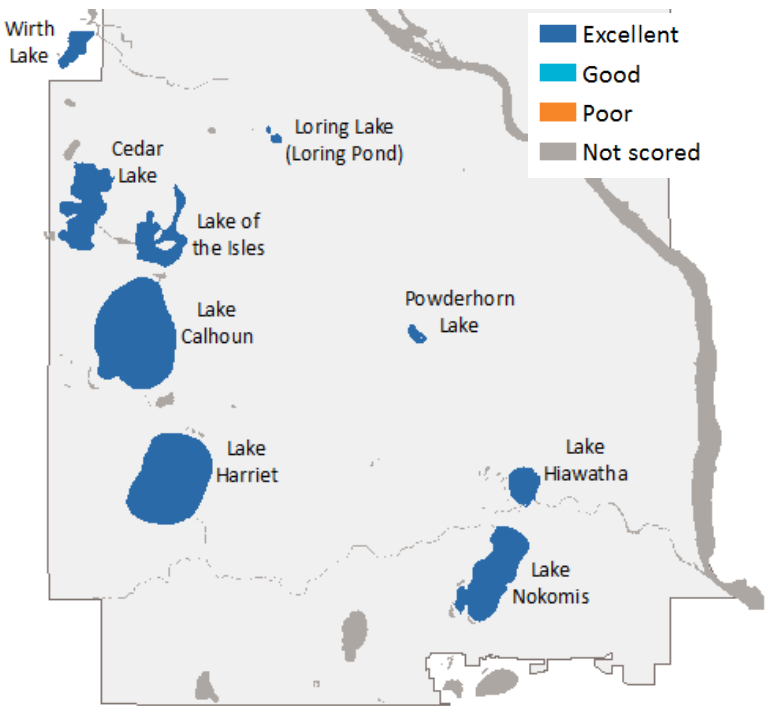
What to know:

- This is measured based on assessments done from shore, beach, dock, or boat. Data is also gathered during *E. coli* sampling for the public health component.
- Scores are averaged over the May to September season.
- Because this measure is based on human-related factors, like trash, and environmental-related factors, like rainfall, there are some year-to-year fluctuations, depending on the lake.

Why it’s important:

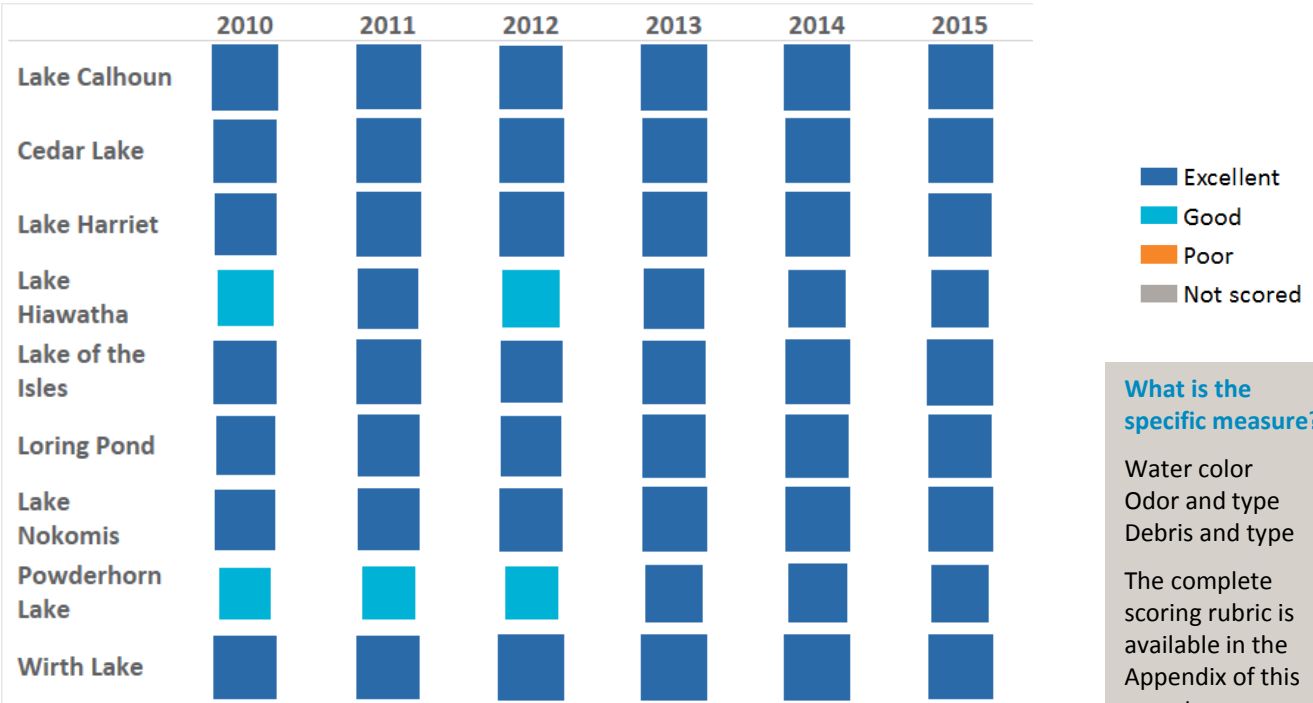
People enjoy and value natural resources that provide pleasant experiences and scenic beauty.

Aesthetic considerations score by measured lake (2015)



Aesthetic considerations score by measured lake (2010-2015)

The size of the square corresponds to the score. Larger squares indicate higher scores.



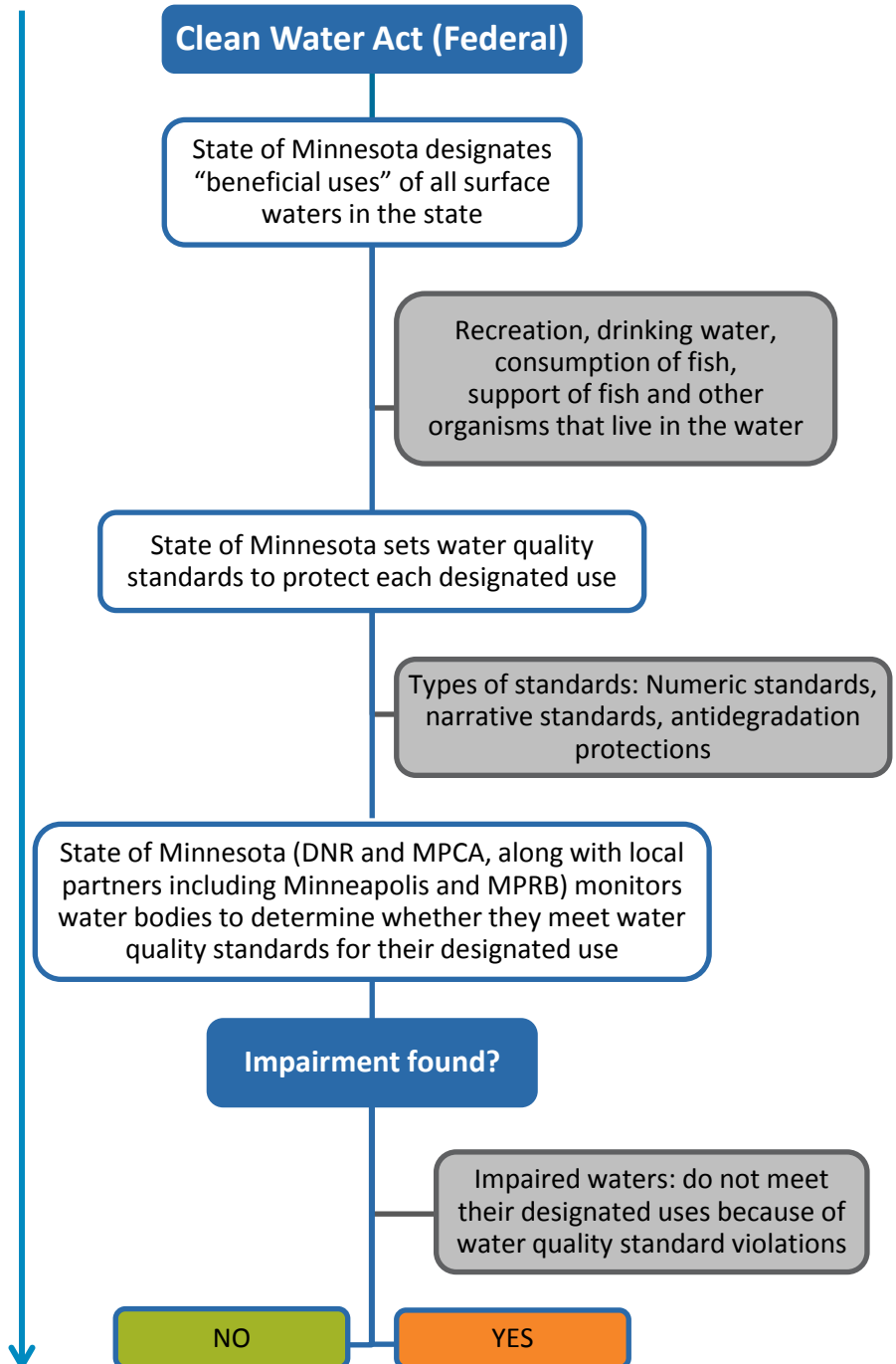
Data source: Minneapolis Park & Recreation Board

Indicator: Impaired water bodies

How do we know a water body is impaired?

The federal Clean Water Act requires the State of Minnesota to set water quality standards to protect specific uses such as fishing and swimming, and determine whether water bodies throughout the state meet those standards. If a water body does not meet one or more state water quality standards, it is added to Minnesota's Impaired Waters List.

It is important to recognize that state water quality standards vary by the "designated use". This means, for example, that water bodies designated as drinking water sources have different standards than those designated for aquatic and recreational uses.

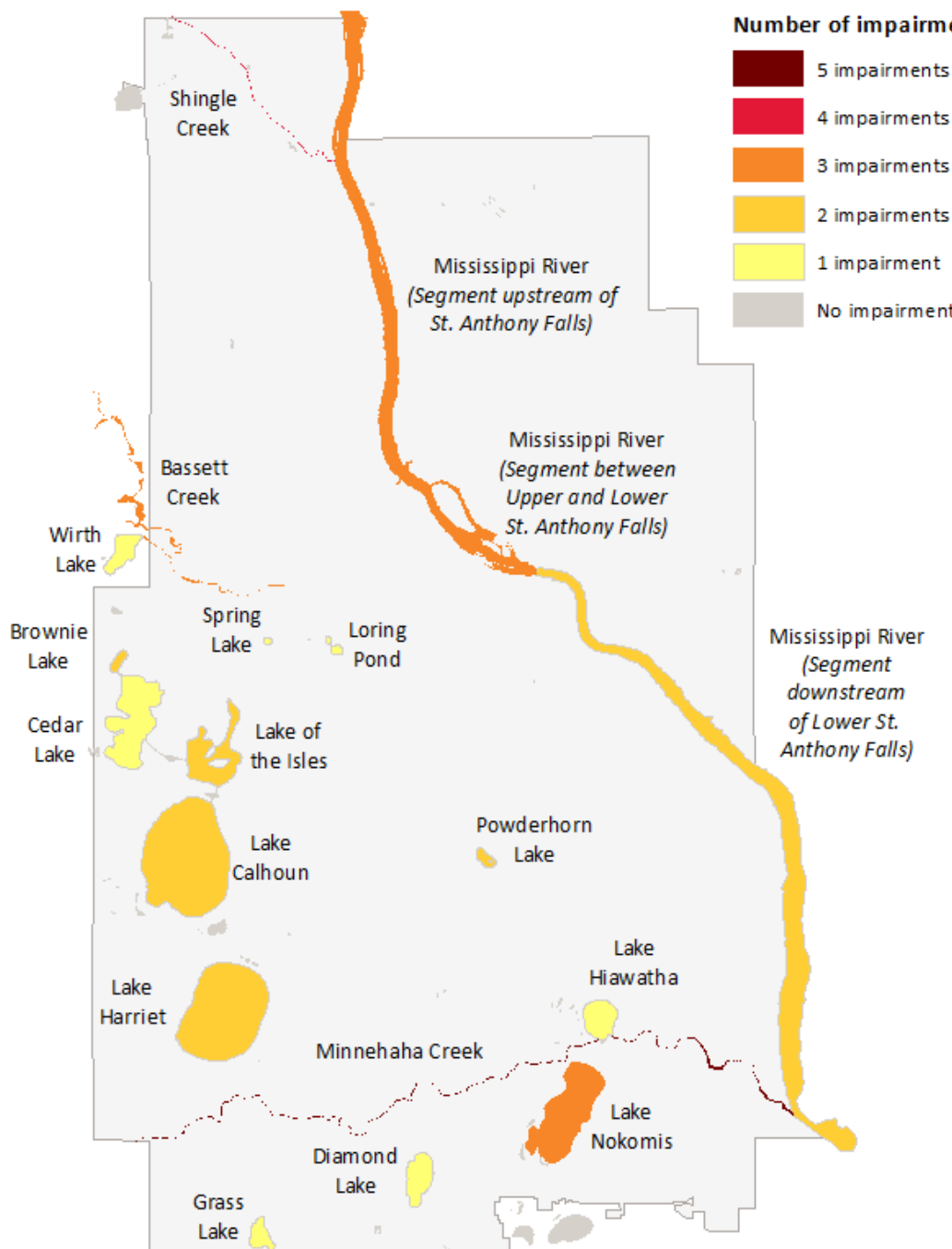


Data source: Minnesota Pollution Control Agency
Minnesota's Impaired Waters list:
<https://www.pca.state.mn.us/water/minnesotas-impaired-waters-list>
Plain-language information about Minnesota's impaired waters:
<http://fmr.org/minnesota%C2%92s-impaired-waters-101>

Indicator: Impaired water bodies

Water body impairments are a long-term measure that may take decades to change.

Impaired water bodies (2014)



These are the measurements that indicate impaired waters in Minneapolis.

These measurements are described in further detail on pages 21-27.

Impairments that impact **aquatic consumption**:

- Mercury in fish tissue
- PCB in fish tissue
- PFOS in fish tissue

Impairments that impact **aquatic life**:

- Aquatic macroinvertebrate bioassessments
- Chloride
- Dissolved oxygen
- Fishes bioassessments

Impairments that impact **aquatic recreation**:

- Bacteria
- Excess nutrients

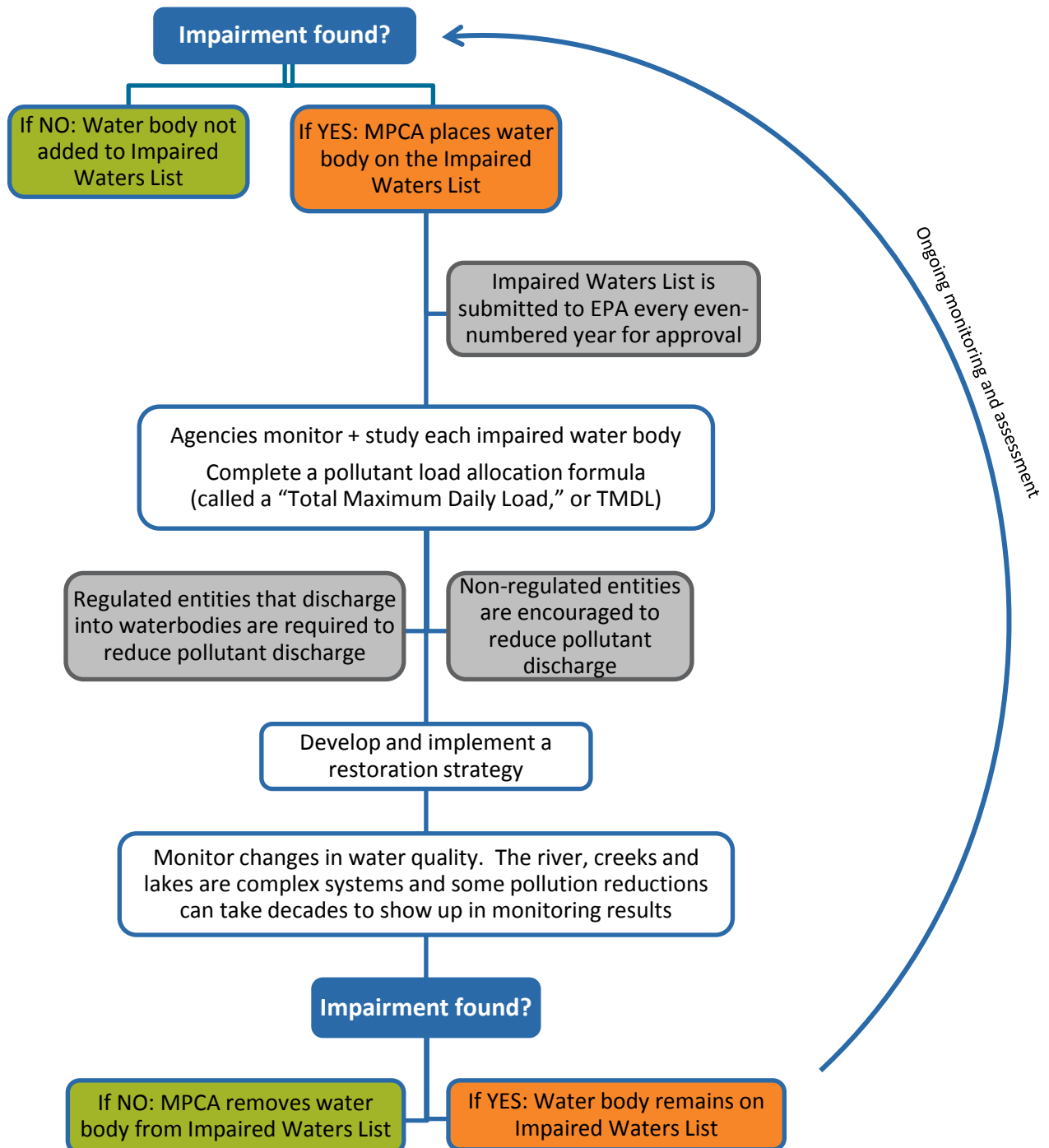
Data source: Minnesota Pollution Control Agency

Indicator: Impaired water bodies

What happens after impairments are found?

The State of Minnesota is required to conduct a Total Maximum Daily Load (TMDL) study for each impaired water body in order to establish goals for water quality improvement. If pollution is reduced enough so that an impaired water body meets state standards again, it can be removed from the Impaired Waters List.

The process of listing impaired waters is a cycle. Over time, water bodies are removed if conditions improve, and new ones are added if conditions worsen or if new standards are established for additional pollutants.



healthy lakes, rivers and streams

PAST PROGRESS HAS IMPROVED WATER QUALITY.

The following pages describe examples that illustrate investments in infrastructure and policy changes that have improved, and will continue to improve, water quality for residents, visitors and downstream users. The health of our lakes, Mississippi River and creeks has improved in many ways because of local actions.

When we focus and take action to reduce water pollution, it can work.

Many historical actions degraded our water bodies starting 150 years ago, including replacing forested areas with streets, rooftops and other hard surfaces, filling wetlands, unregulated industrial uses, using creeks, swamps and the river for waste, and the arrival of motor vehicles. Over time, policy changes and local investments in infrastructure have greatly improved the quality of our surface waters.

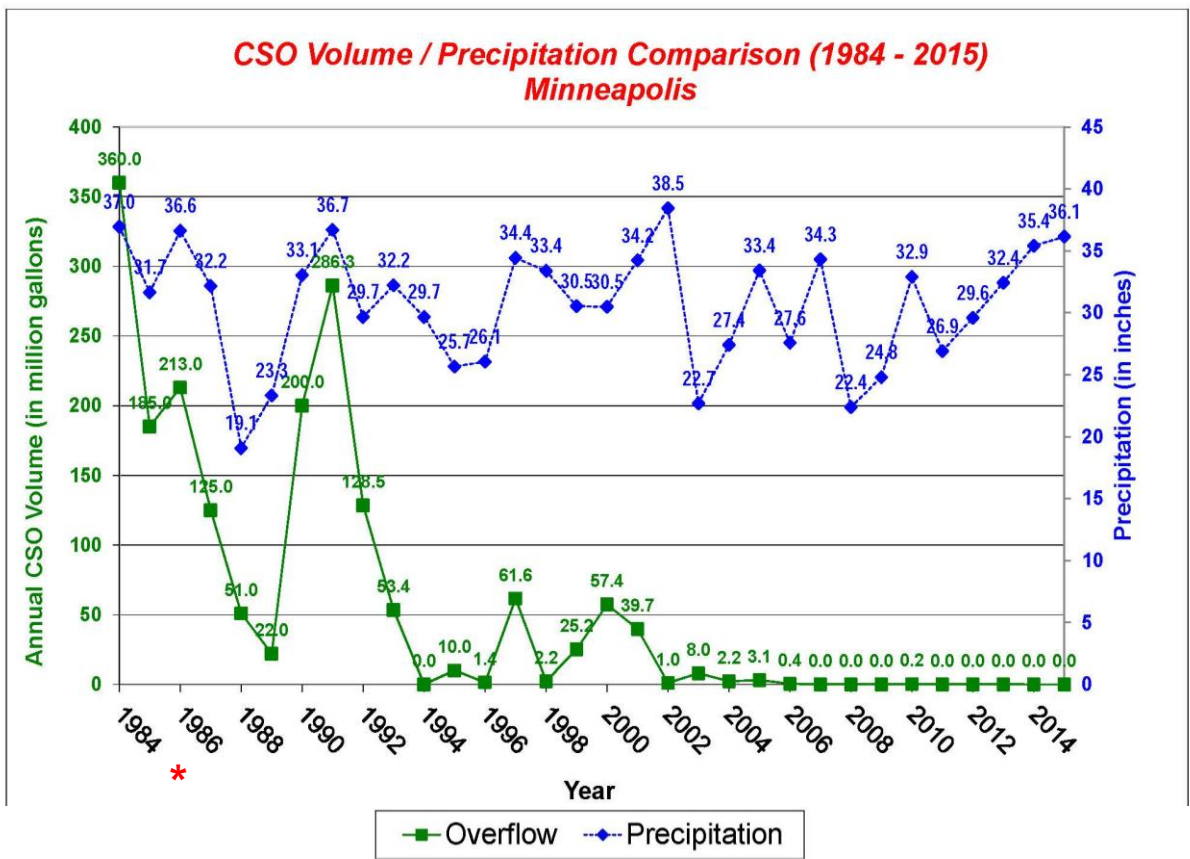
Action case study: Combined Sewer Overflow (CSO) program

One key action the City has taken is separation of the City's storm sewers from its sanitary sewers, an expensive process that has taken many decades.

As in other older cities, Minneapolis sewers originally carried both sewage and stormwater directly to the river, before the first wastewater treatment plant was built. Since 1930, Minneapolis has steadily carried out a series of programs to separate flow and reduce Combined Sewer Overflows (CSOs). A CSO would occur when a heavy rainstorm caused sewage to enter the Mississippi River through an outfall point. The City has one of the most successful CSO programs in the country.



Mississippi River Pollution – Courtesy of the Minnesota Historical Society



* Volume in the mid-1930s may have been 1,000 times greater than 1984! (No actual data available)

When we focus and take action to reduce water pollution, it can work.

Action Case Study: Rainleader Disconnect Program

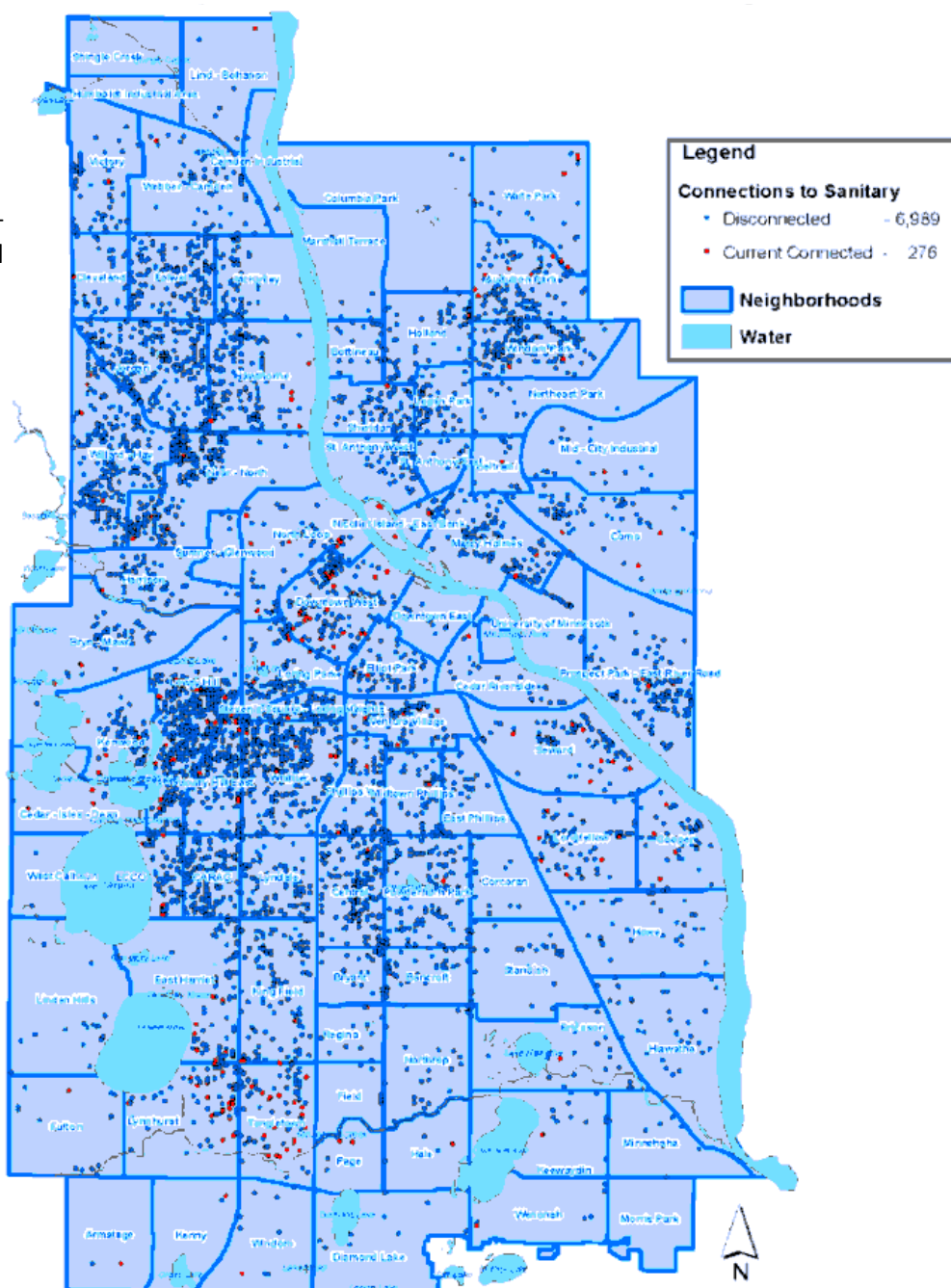
Many buildings, usually built before 1961, had connections to the combined sewer system for rooftop runoff, rather than draining onto lawns or into storm sewers. During rain events, stormwater runoff from buildings and properties still connected to the sanitary sewer system would sometimes exceed the system's capacity, and contribute to Combined Sewer Overflows to the Mississippi River (see Action Case Study on previous page).

To protect the environment and to prevent sewer backups into homes and businesses, the City launched the Rainleader Disconnect Program in 2003. The City's 100,000+ properties were inspected for connections, and required disconnections began.

Only a few hundred connections remain, of more than 7,000 that existed in 2003.

The result is a cleaner Mississippi River and a dramatically reduced risk of sewer backups.

Rainleader Disconnect Program: Disconnections from the Sanitary Sewer System (as of March 1, 2016)



Created by Rainleader Disconnect Program Staff 03/01/2016

When we focus and take action to reduce water pollution, it can work.

Action Case Study: Permanent weir for Lake Nokomis

In the past, Lake Nokomis received water from Minnehaha Creek during rainstorms. Because Minnehaha Creek has lower water quality, it negatively impacted the water quality in Lake Nokomis.

In 2000, a temporary inflatable “floating” weir was installed to serve as a barrier between the creek and the lake. This project was a partnership between the City of Minneapolis, the Minneapolis Park & Recreation Board, and the Minnehaha Creek Watershed District.

The Minnehaha Creek Watershed District funded the installation of a permanent weir in 2012. The purpose of the new weir was to better protect Lake Nokomis from polluted storm sewer discharges and to reduce movement of zebra mussels, an invasive species, from Minnehaha Creek to the lake.

The new weir is operated by the Minneapolis Park & Recreation Board. The operating plan was approved by the Minnesota Department of Natural Resources and is administered by the Minnehaha Creek Watershed District.

Investments in infrastructure can result in positive impacts on our water quality.



Image source: Minneapolis Park & Recreation Board

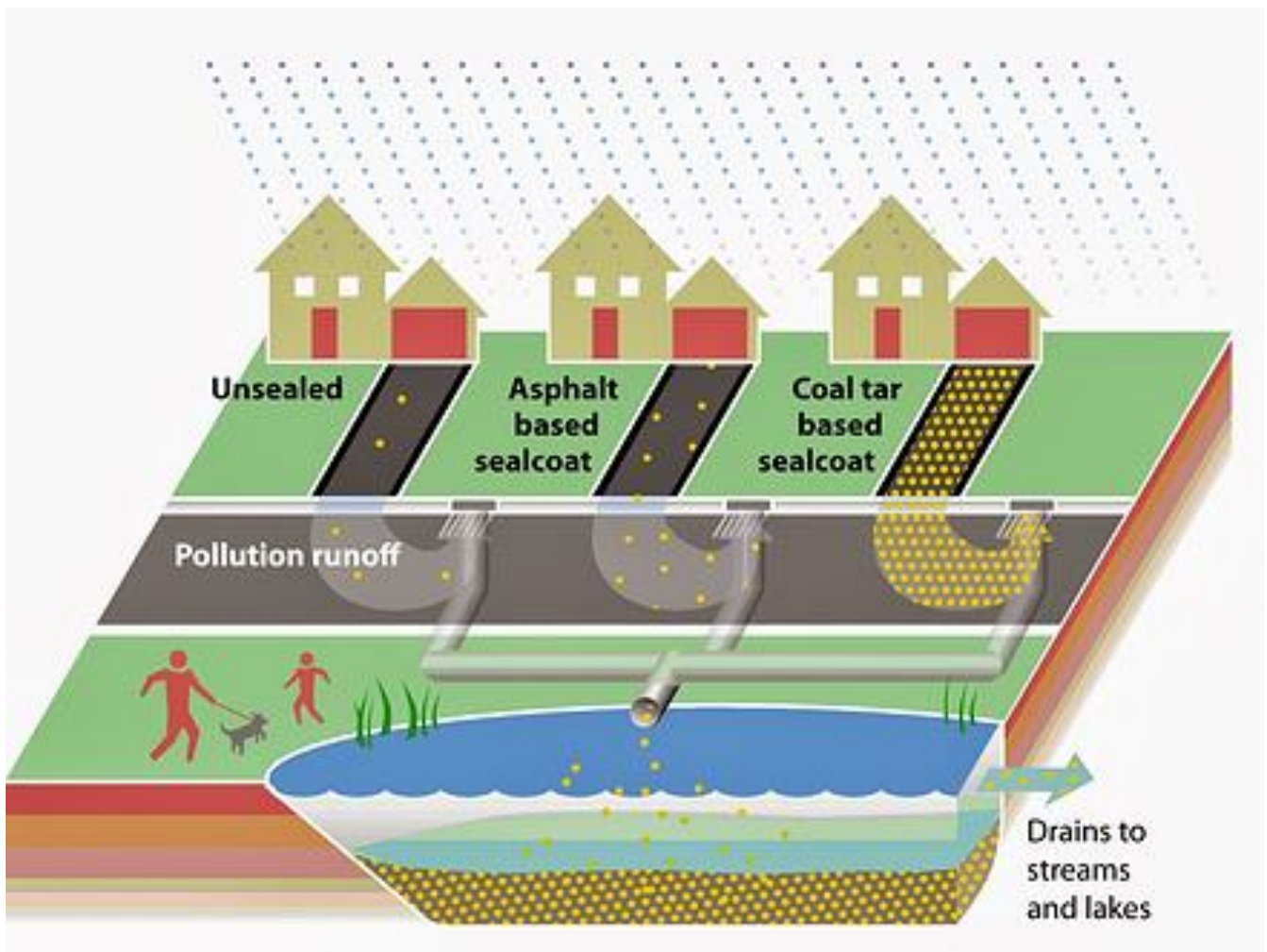
When we focus and take action to reduce water pollution, it can work.

Action Case Study: Ordinance to ban coal tar sealant on paved surfaces

In 2012, the City of Minneapolis approved an ordinance to prohibit the use of coal tar sealant on driveways, parking lots, or other surfaces. In 2014, the Minnesota Legislature also imposed a statewide ban.

Coal tar is a prominent source of Polycyclic Aromatic Hydrocarbons (PAHs), which as the sealant wears off of driveways or parking lots, is carried by stormwater runoff to water bodies and harms aquatic life.¹

PAHs are known to be carcinogenic, and therefore pose a threat to public health. In addition to polluting water bodies, PAHs from coated surfaces can also be tracked into homes and can contaminate soil.



1. United States Geological Survey. <http://pubs.usgs.gov/fs/2016/3017/fs20163017.pdf>

Image source: <http://atlanticasphaltproducts.com/coal-tar-bans/>

healthy lakes, rivers and streams

TODAY, MANY SOURCES OF DEGRADATION AND POLLUTION IMPACT WATER QUALITY.

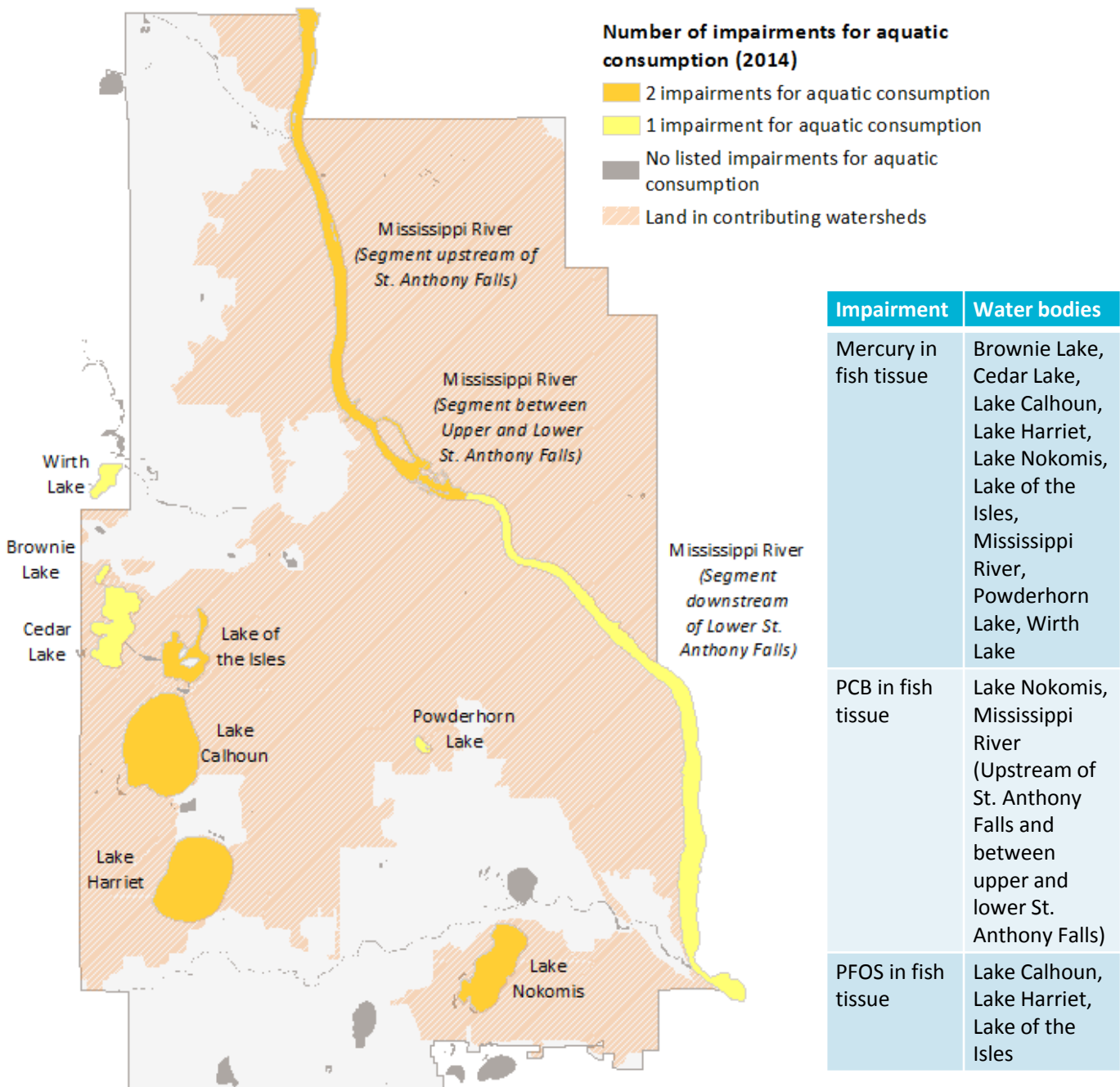
These impairments affect public health, habitat quality, and recreational opportunities. Every water body is different: Factors such as landscape position, elevation, depth, flushing time and the water body's own accumulated pollutant loads can impact monitoring results.

Control of some pollutant sources can be influenced by City regulations or mitigation efforts. The City can either regulate the source itself, like construction sites, or mitigate the impacts on our waters, like adding structural controls as part of the City's infrastructure. Some pollutant sources cannot be controlled directly by the City. Some sources are outside the geographic boundaries of the City, and some are due to restrictive state or federal regulations.

Some types of water pollution lead to advisories about consuming fish from certain water bodies.

- Currently, some of our waterways are impaired for aquatic consumption, indicated in the map below. These problems are regulated by the Minnesota Pollution Control Agency and are not under the control of Minneapolis.
- Aquatic consumption impairments affect the health of animals or humans who consume fish from the impaired water. Impairments specifically impacting aquatic consumption in Minneapolis are mercury, PCBs (polychlorinated biphenyls), and PFOS (perfluorooctane sulfonate).

Water bodies with impairments that impact aquatic consumption (2014)



Data source: Minnesota Pollution Control Agency, Minneapolis Public Works Department

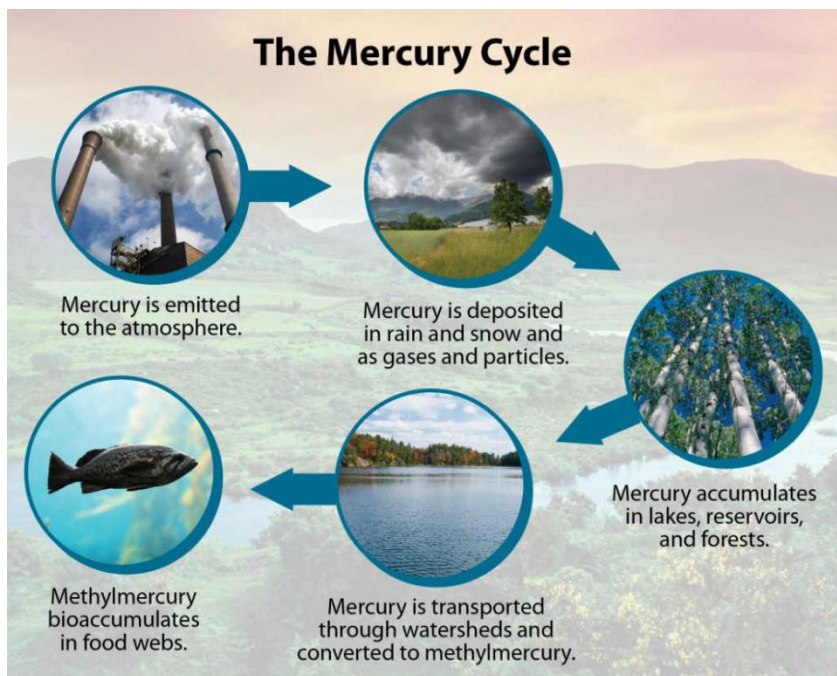
The pollutants involved in fish advisories for Minneapolis waterbodies are under regulatory control by the state, not the City.

Although exposure to mercury, PCB, and PFOS represents an important public health issue, there is little the City of Minneapolis can do to directly reduce sources of these pollutants.

Mercury

Mercury is a global pollutant that is often deposited into water bodies from the atmosphere. It does not break down over time.

Mercury gets into the water body from the air, not from stormwater runoff. Even small amounts can bioconcentrate up the food chain, meaning that fish – especially larger, older fish – can have much higher levels of mercury than the surrounding water body. Mercury has serious effects on human health. The Minneapolis Pollution Control Agency, not the City of Minneapolis, regulates this pollutant, and is observing significant reductions in airborne mercury over time.



Fish advisories

The Minnesota Fish Consumption Advisory program of the Minnesota Department of Health includes recommendations for consumption of fish based on contaminant levels. There are three categories: Unlimited consumption, 1 meal per week, 1 meal per month, and do not eat. Learn more: <http://www.health.state.mn.us/divs/eh/fish/>.

Mercury Cycle image source: <http://webcam.srs.fs.fed.us/impacts/mercury/>

Minneapolis Fishing image source: <http://www.minneapolis.org/things-to-do/outdoors/fishing-water-sports/>

PCB and PFOS

PCB and PFOS are created in specific industries.

PCBs (Polychlorinated biphenyls) are global compounds used extensively for industrial purposes. PFOS (perfluorooctane sulfonate) is part of a group of chemicals created in the second half of the twentieth century. PCBs and PFOS also do not break down over time, can bioconcentrate, and are harmful to human health. These pollutants are also regulated by the MPCA, not the City of Minneapolis. Whereas the manufacturing and use of these chemicals has been significantly phased out, they are still in the environment in soil and water. The MPCA has identified the former industrial properties that are the sources of these pollutant discharges to Minneapolis waters, and is working toward elimination.

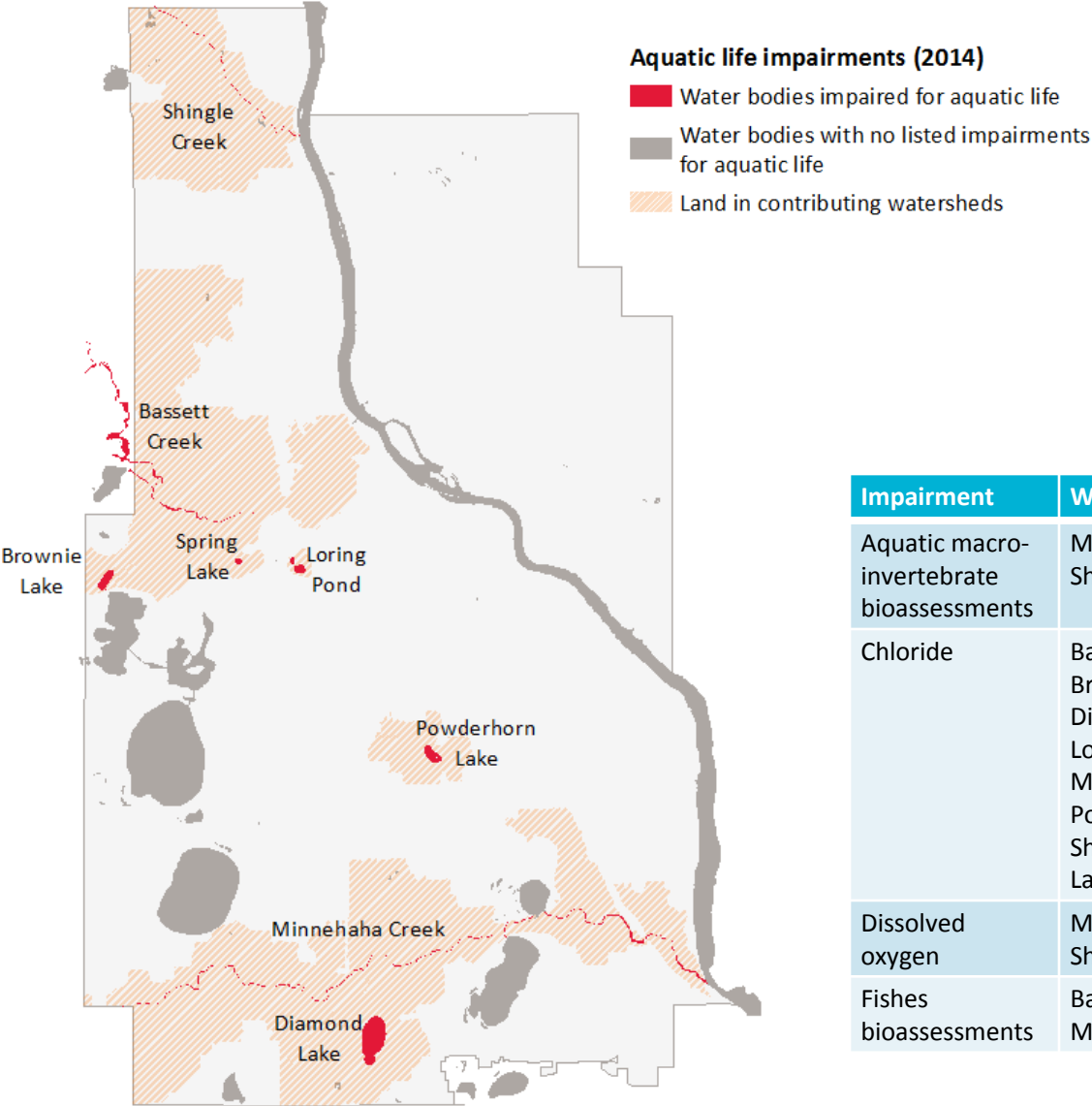
Some types of water pollution affect habitat quality or pose a threat to aquatic life. These types of pollution make it difficult for fish, macroinvertebrates like snails and insects, and native aquatic plants to thrive in and around a water body.

Meeting aquatic life standards can be defined as:

- (a) maintaining healthy, diverse, and successfully reproducing populations of aquatic organisms,
- (b) protecting the aquatic community from the direct harmful effects of toxic substances, and
- (c) protecting of human and wildlife consumers of fish or other aquatic organisms.¹

Impairments specifically impacting aquatic life in Minneapolis include chloride (road salt) and dissolved oxygen. An indicator of impairments to aquatic life is insufficient biological integrity of aquatic macroinvertebrate and fish communities.

Water bodies with impairments that impact aquatic life (2014)



Impairment	Water bodies
Aquatic macro-invertebrate bioassessments	Minnehaha Creek, Shingle Creek
Chloride	Bassett Creek, Brownie Lake, Diamond Lake, Loring Pond, Minnehaha Creek, Powderhorn Lake, Shingle Creek, Spring Lake
Dissolved oxygen	Minnehaha Creek, Shingle Creek
Fishes bioassessments	Bassett Creek, Minnehaha Creek

1. Minnesota Department of Natural Resources (2016). *Water Quality*. http://www.dnr.state.mn.us/whaf/about/5-component/wq_concepts.html

2. Data source: Minnesota Pollution Control Agency, Minneapolis Public Works Department

Reducing chloride levels involves competing values and tradeoffs.

- Road salt is used to improve public safety when roads are icy, but can run off into water and harm aquatic life. This represents a tradeoff between public safety and water quality.
- The MPCA regulates the road authorities operating in the City – Public Works, MnDOT and Hennepin County. The challenge is to find ways to reduce salt usage, while continuing to address public safety.
- Private parties – individuals, contractors working for businesses or other property owners, are not regulated. The City and other governmental partners carry out education to motivate voluntary salt reduction. Incentive programs are also being considered.

Chloride

- Use of chloride (road salt) is driven by climate and weather.
- Chloride does not break down over time – it persists in waterways and soil.
- One teaspoon of salt pollutes five gallons of water, leading to loss of aquatic species that cannot tolerate the condition.
- Chlorides are entering groundwater systems and, over time, may cause drinking water problems.



Additional impairments that impact habitat quality:



Dissolved oxygen

Dissolved oxygen is essential for survival of organisms that live in the water. This is compromised when phosphorus and nitrogen levels are high, raising levels of algae, which reduces levels of oxygen when they decompose.

- For Shingle Creek (image at left), low-oxygen discharge from headwaters wetlands and the overwide channel are the causes of high dissolved oxygen.
- Minnehaha Creek is impaired because it has very low flows seasonally when the Gray's Bay Dam on Lake Minnetonka is in operation.

Bioassessments of fish and macroinvertebrates

The presence and diversity of fish and macroinvertebrates is a direct indicator of habitat quality.

- Minnehaha Creek is impaired, because it has very low flows seasonally when the Gray's Bay Dam on Lake Minnetonka is in operation.
- Bassett Creek is impaired, but possibly in error. Resampling will be carried out.



Chloride image source: <https://www.pca.state.mn.us/water/road-salt-and-water-quality>

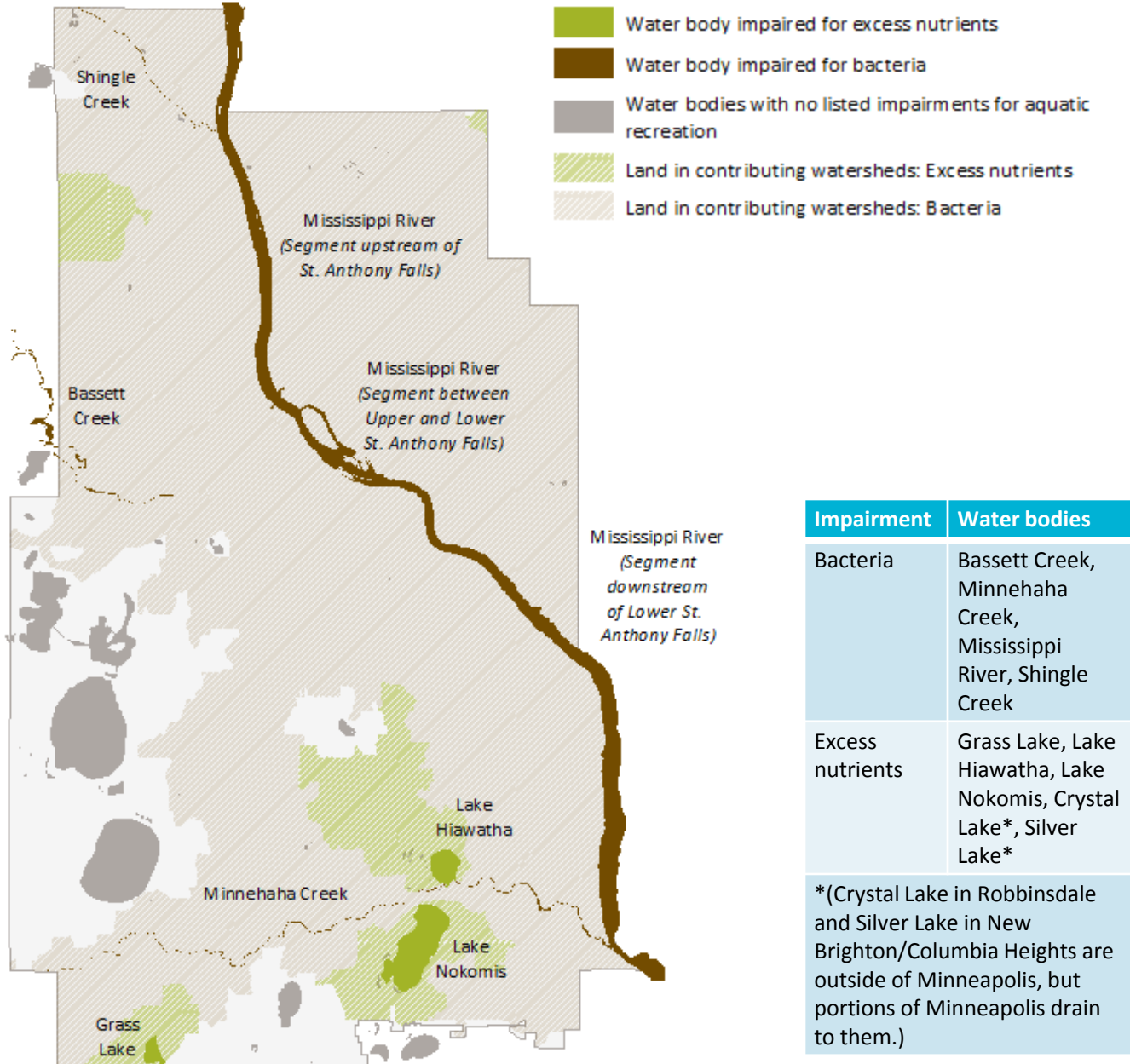
Dissolved oxygen image source: <https://www.pca.state.mn.us/water/tmdl/shingle-and-bass-creeks-impaired-biota-and-dissolved-oxygen-tmdl-project>

Bioassessments image source: <https://www.pca.state.mn.us/water/biological-monitoring-water-minnesota>

Some sources of pollution affect humans’ ability to engage in water-related recreation.

Aquatic Recreation impairments affect the ability of humans to safely use water bodies for recreational purposes. Recreational uses of water bodies can be divided into two categories. Primary body contact includes “swimming and other recreation where immersion and inadvertently ingesting water is likely.” Secondary body contact includes recreation such as “boating and wading where the likelihood of ingesting water is much smaller.”¹

Water bodies with impairments that impact aquatic recreation (2014)



1. Minnesota Pollution Control Agency (2014). *Guidance Manual for Assessing the Quality of Minnesota Surface Waters*. <https://www.pca.state.mn.us/sites/default/files/wq-iw1-04.pdf>

2. Data source: Minnesota Pollution Control Agency, Minneapolis Public Works Department

Recreational opportunities, like beach access, are impacted when bacteria levels in the water are too high.

Beach closings can occur for a variety of reasons. Beaches are closed when the measured *E. coli* level exceeds the acceptable limit recommended by the United States Environmental Protection Agency and the Minnesota Pollution Control Agency. A precautionary closing could also occur if a nearby sewer break or other suspected contamination were to occur.

High *E. coli* levels are commonly found after rainstorms when bacteria from a variety of sources, including pets, geese and other waterfowl, run off into water bodies.



Bacteria

- Bacteria impacts aquatic recreation during the summer months by impacting the safety of swimming.
- The bacteria impairment in Minnehaha Creek directly impacts the amount of bacteria in Lake Hiawatha, which results in a high number of closings of Lake Hiawatha Beach.

Excess nutrients

- Excess nutrients lead to excess growth of algae. This can be unsightly, but is rarely dangerous. However, contact with blue-green algae, a specific form (shown in the photo at right), can cause illness in certain circumstances.
- Some excess nutrients settle to the bottom of the water body, but can be resuspended later by bottom fish like carp, wave action by motorboats, or other turbulence.
- Major contributors of excess nutrients in Minneapolis include soil erosion, over-irrigation, or leaving leaves and grass clippings on the street and other pavement where they wash into storm sewers.
- Minneapolis in 2001, and the State of Minnesota in 2002, have generally banned the use of phosphorus in lawn fertilizers.








How can residents help?

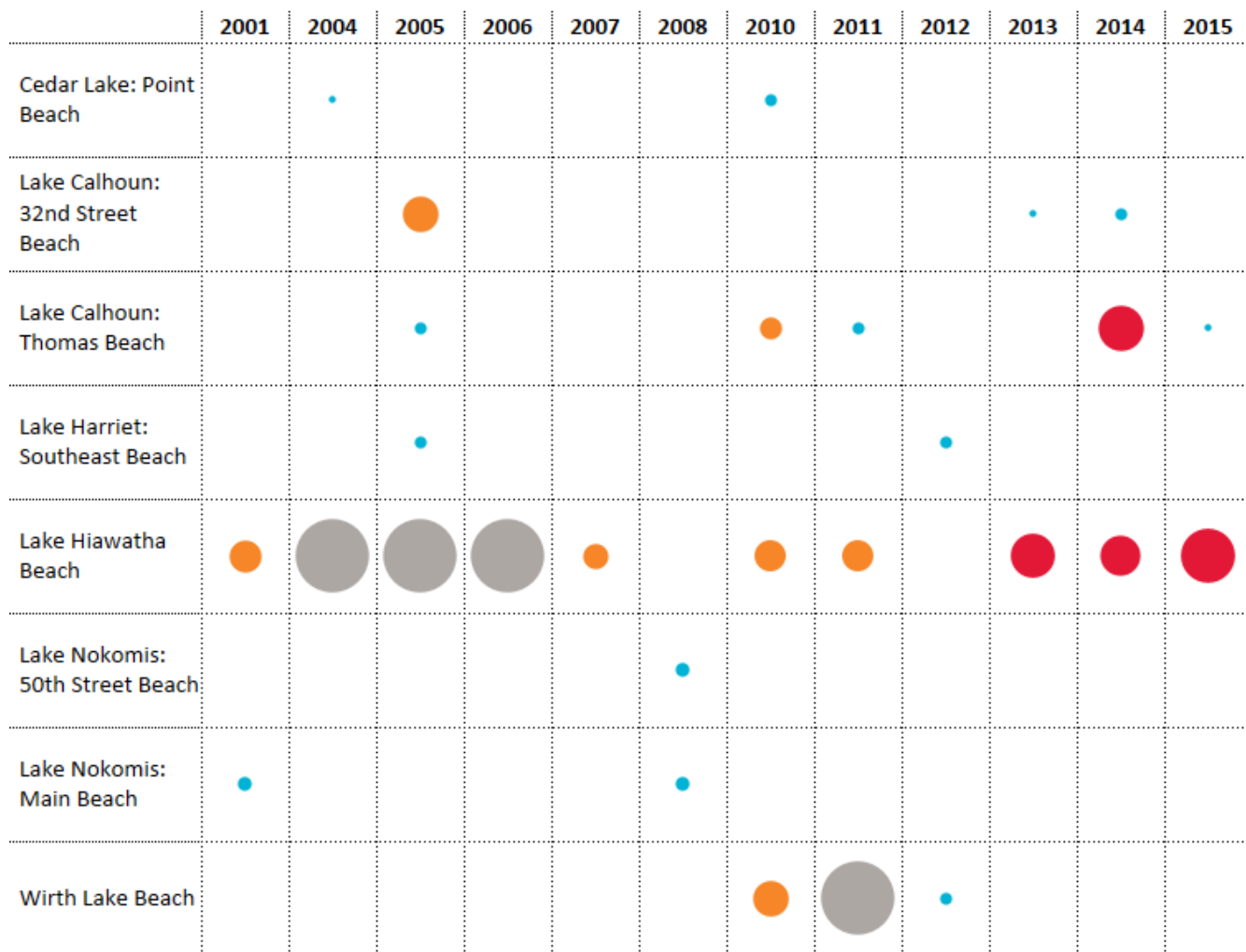
- Sweep up grass clippings or leaves from sidewalks, driveways or gutters.
- Don't over-water your lawn or other plants
- Pick up dog waste.

Recreational opportunities, like beach access, are impacted when bacteria levels in the water are too high.

Number of beach closing days by beach (2001-2015)

The size and color of the dot represents the number of days each beach was closed each year. Larger dots represent more days closed.

Closed fewer days:    Closed more days:  Closed all season (see notes below): 



Large grey dots mean the beach was closed for an entire season.

- Lake Hiawatha Beach was closed the entire season in 2004, 2005, and 2006 due to budget constraints.
- Wirth Lake Beach was closed the entire season in 2011 due to construction and tornado damage.

Note: There were no beach closings in 2002 or 2009.

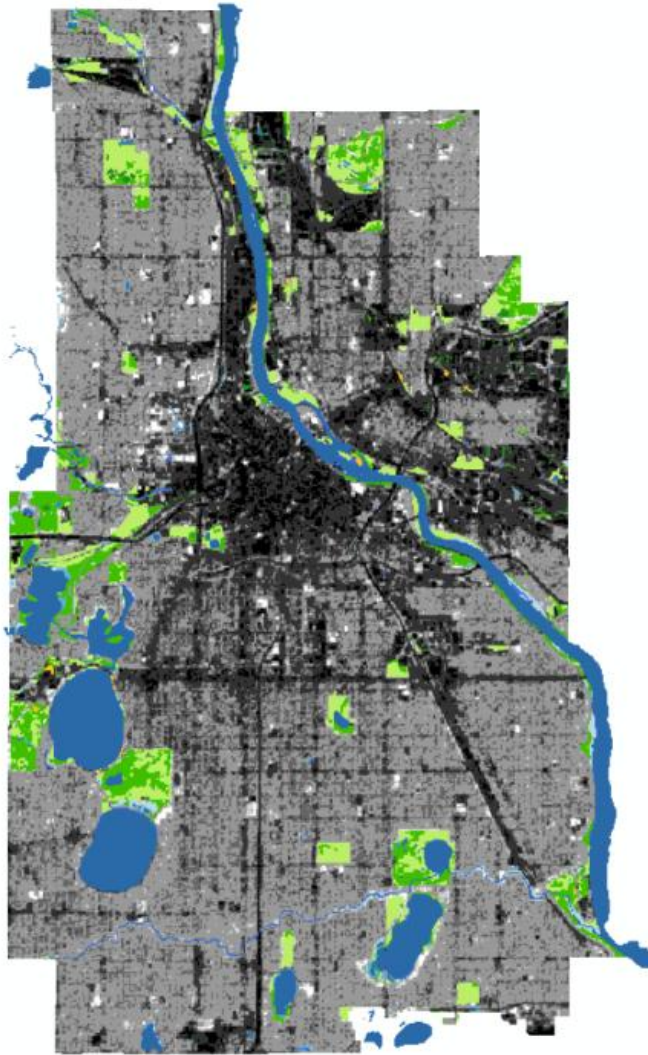
2003 is not included because the beach closing procedure was implemented in mid-summer. 2003 is not comparable to subsequent years.

Data source: Minneapolis Park & Recreation Board

Land use has a major impact on water quality, and is something that the City can help to influence in the long term.

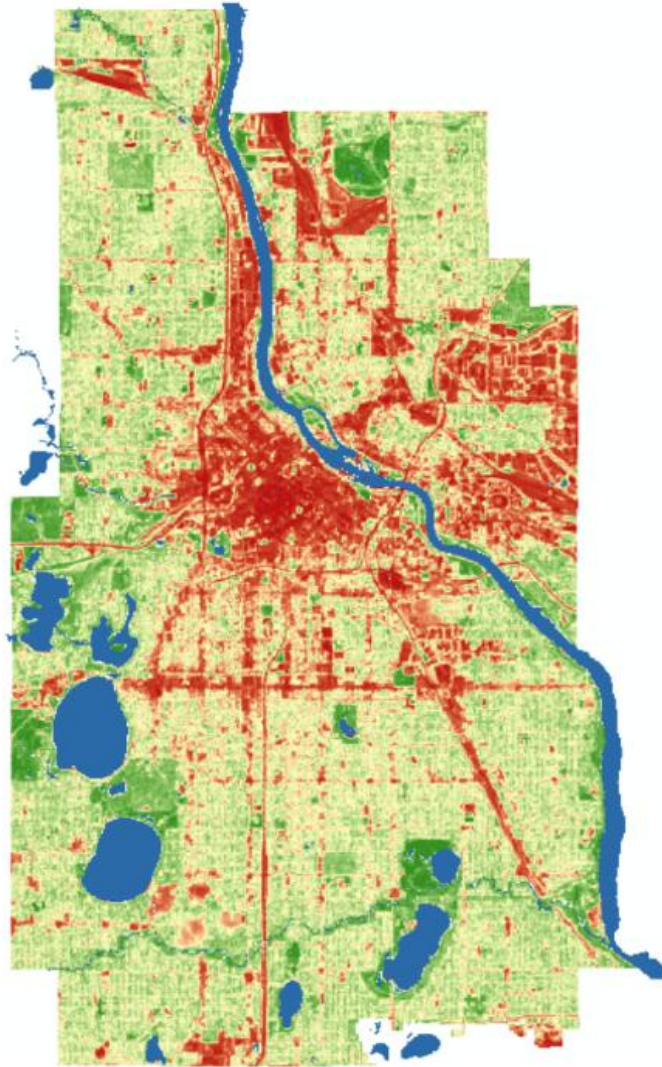
Trees, deep-rooted vegetation like prairie plants, and wetlands help slow down runoff and filter pollutants before they reach our water bodies. Actions residents can take is to plant trees, add raingardens, or replace areas of turf with prairie plants.

Impervious surface (2013)¹



Least Impervious surface  Most Impervious surface

Vegetation cover (2015)²

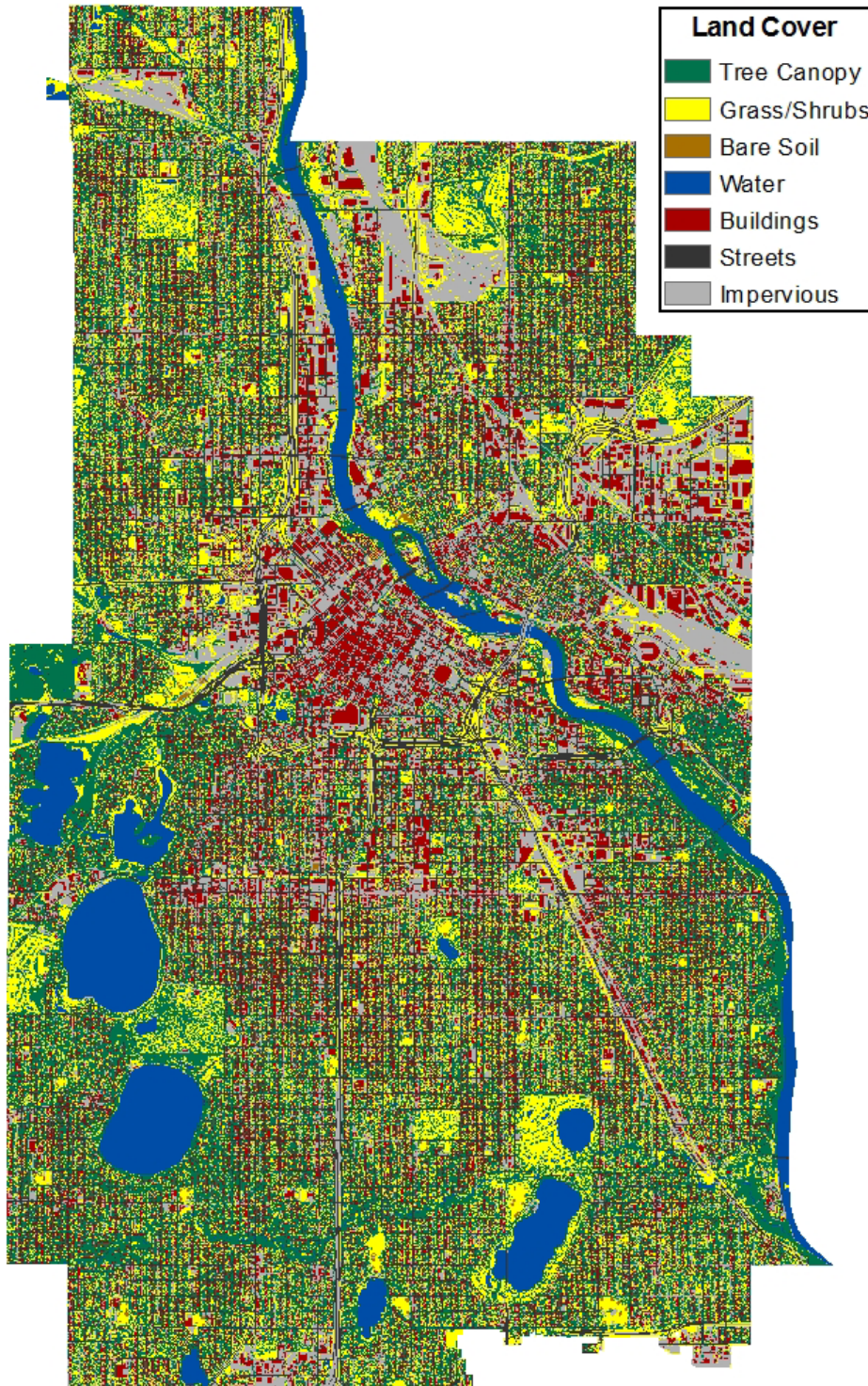


Most vegetation  Least vegetation

1. Data source: Remote Sensing and Geospatial Analysis Lab at the University of Minnesota (2013). http://portal.gis.umn.edu/map_data_metadata/LandCover_MN2013.html
2. Data source: United States Geological Survey (7/20/15). <http://earthexplorer.usgs.gov/>

Land use has a major impact on water quality, and is something that the City can help to influence in the long term.

Land cover by parcel (2010)¹



In 2009 tree canopy covered 31.5 percent of the City, about 18 square miles. Trees reduce stormwater runoff and result in other significant environmental and economic benefits.

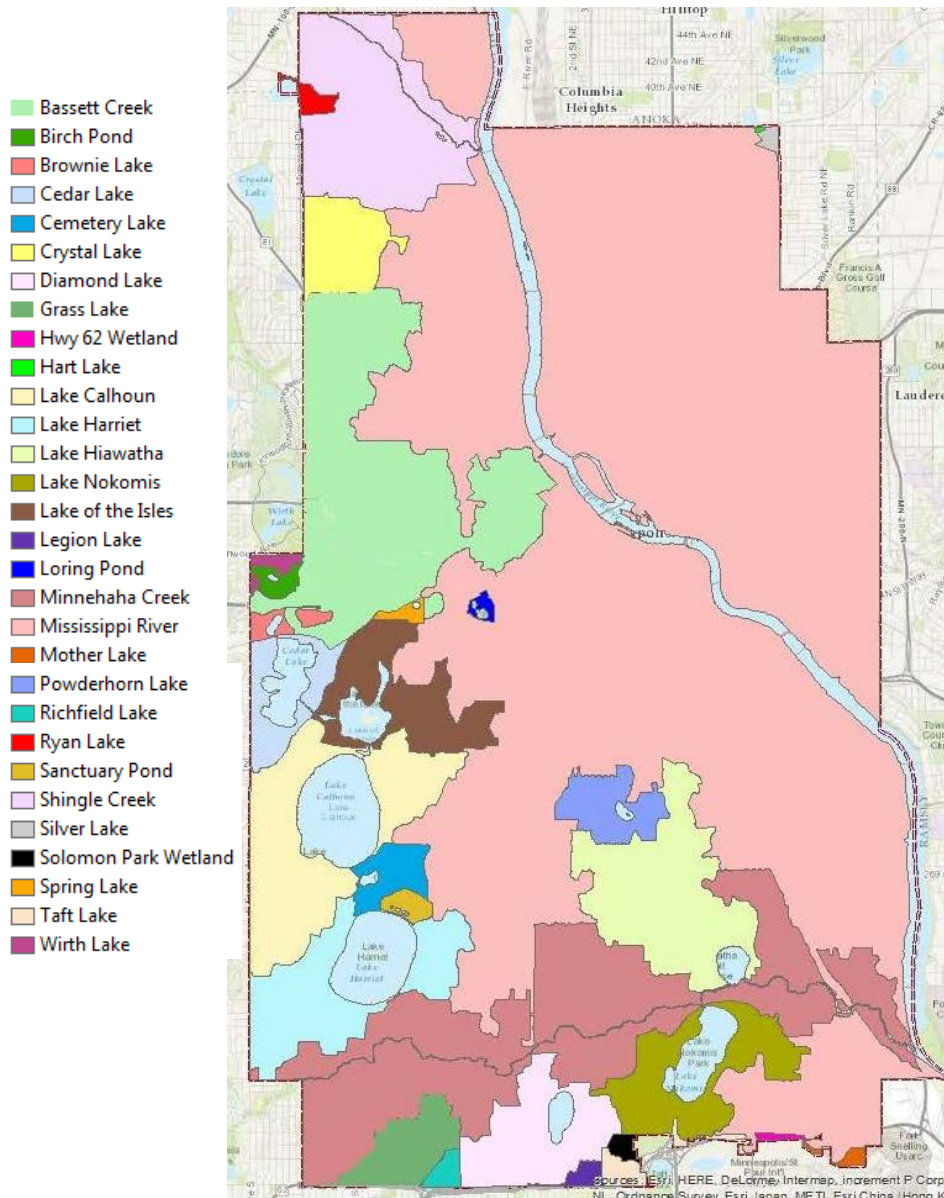
A University of Minnesota research group found that under the right circumstances, trees could potentially cover an additional 37.5% of the City, over 21 square miles.²

1. Data source: Remote Sensing and Geospatial Analysis Lab at the University of Minnesota (2010).

2. http://www.ci.minneapolis.mn.us/www/groups/public/@citycoordinator/documents/webcontent/convert_261908.pdf

Collaboration at the watershed scale is essential.

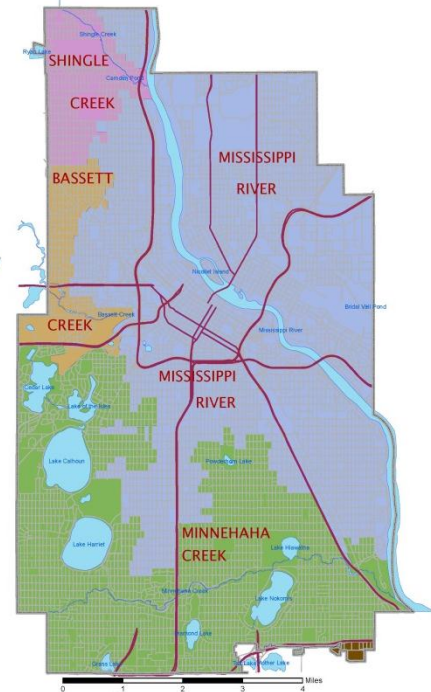
A. Minneapolis watersheds draining to receiving water bodies



A. A watershed is the area of land that drains into a water body when it rains or when snow melts. Water flows from land within a watershed into our storm sewer system, and then into our lakes, river and streams. Some water also flows over the land directly into our water bodies.

The size of a watershed and the land use mix within it have a strong influence on water quality. If rainfall cannot soak into the ground, it travels into our storm sewers as runoff and quickly reaches our water bodies. Some watersheds are small, and only include Minneapolis properties. However some watersheds extend well beyond the City's boundaries, which means that the quality of our waterways is heavily influenced by actions taken by governments and landowners outside of Minneapolis.

B. Boundaries of watershed organizations that cover portions of Minneapolis



B. A watershed organization is a collaboration of governments that drain to one or more water bodies, with responsibilities under the State Legislature, for geographic areas larger than a single city.

There are four watershed organizations that cover portions of Minneapolis, and beyond -- they are associated with the creeks and river that flow through Minneapolis: Bassett, Shingle and Minnehaha Creeks, and the Mississippi River.

Collaboration at larger geographic scales is also required in order to be effective.

Water quality protection is a local, regional, statewide, national and even global issue. The regulatory environment is complex. The City of Minneapolis partners with many other entities to protect water quality.

City + Minneapolis Park & Recreation Board:

The City of Minneapolis and the Minneapolis Park & Recreation Board are co-permittees on the stormwater discharge permit under the federal Clean Water Act, and work closely together to fulfill regulatory responsibilities and as stewards of water resources and infrastructure.

The Minneapolis Park & Recreation Board is the primary organization that does water quality monitoring in the Minneapolis lakes. The Park Board also carries out monitoring of stormwater and stormwater Best Management Practices in Minneapolis. Monitoring and education activities are detailed in the MPRB's Annual Water Resources Report.

City + neighboring cities, watershed organizations:

Work together to fund and carry out projects and programs, training and research, adopt cooperative agreements, develop and share education and training. MWMO, MCWD, and MPCA The Minneapolis Park & Recreation Board provides information to Hennepin County Environmental Services.

City + county:

Work together to identify water quality and other stormwater management infrastructure needs for County road and bridge projects, adopt cooperative agreements. (Hennepin County has jurisdiction over 83.5 miles of roads within Minneapolis)

City + Met Council Environmental Services:

Collaborate on the CSO program, controlling private discharges to the storm and sanitary systems and billing for sewer service.

City + MNDOT:

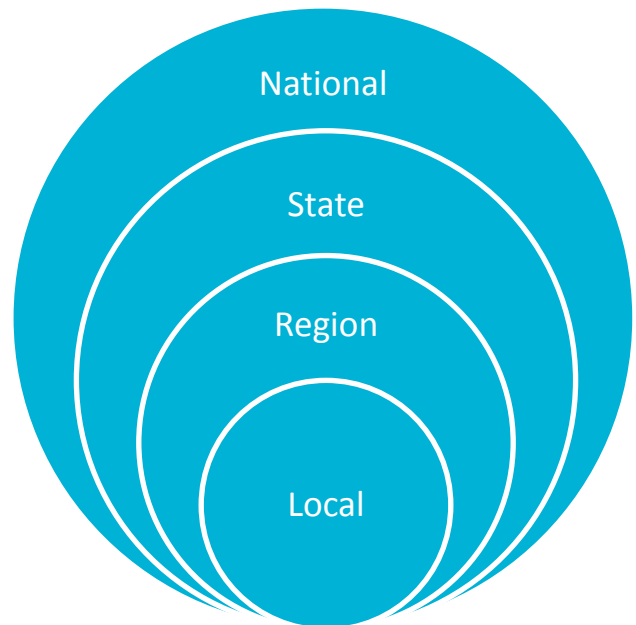
Work together to identify water quality and other stormwater-related needs for State road and bridge projects, adopt cooperative agreements, share research and training. (MNDOT has jurisdiction over 46.3 miles of the roadway within the City)

City + state agencies

The City and Park Board have partnerships with state agencies including the Pollution Control Agency, Department of Natural Resources, Department of Health and Department of Agriculture related to research, funding, education and training, and other opportunities.

City and University of Minnesota

Collaborate on research, studies and training, work together to identify water quality and other stormwater-related needs for U of M road and other projects.



City + federal agencies

The City provides input to EPA for studies and benefits from EPA funding and research. The Park Board also partners with the USGS on projects.

City and organization of cities across the nation

City participates in state and federal coalitions of cities for stormwater research, advocacy and information sharing.

Local colleges and universities

The Park Board also partners with local colleges and universities.

Local efforts to manage stormwater runoff improve water quality.

The heaviest pollutant loads in stormwater runoff come from the first part of the storm – sometimes called the first flush – when pollutants are washed off of surfaces, into the storm drains, and into our waterways. Allowing rain to infiltrate into the ground close to where it falls can reduce runoff of chlorides, bacteria, sediments, phosphorus, metals and other pollutants into our waterways. The Minneapolis Stormwater Management Program describes City and Park Board actions to address pollutants in stormwater runoff. Controlling the rate of runoff is also important, because large volumes of stormwater runoff can damage water bodies by scouring banks or inundating habitat.

City Stormwater Ordinance

Developers of new construction or reconstruction projects over a certain size must follow stormwater management requirements including implementation of stormwater treatment devices. To ensure that the treatment devices continue to function over time, an annual report is required and City staff inspects the sites.

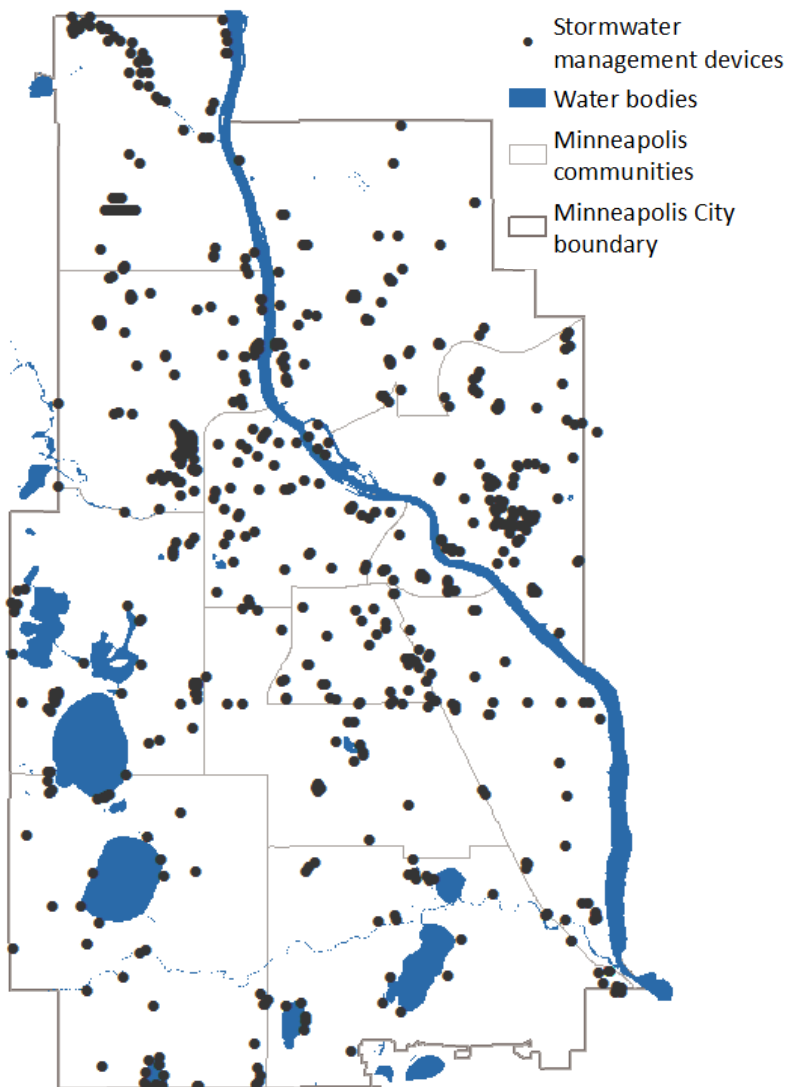


Infiltration basin at Heritage Park



Grit chamber under construction near Minnehaha Creek

Stormwater management devices (public and private)



Types of stormwater management devices:

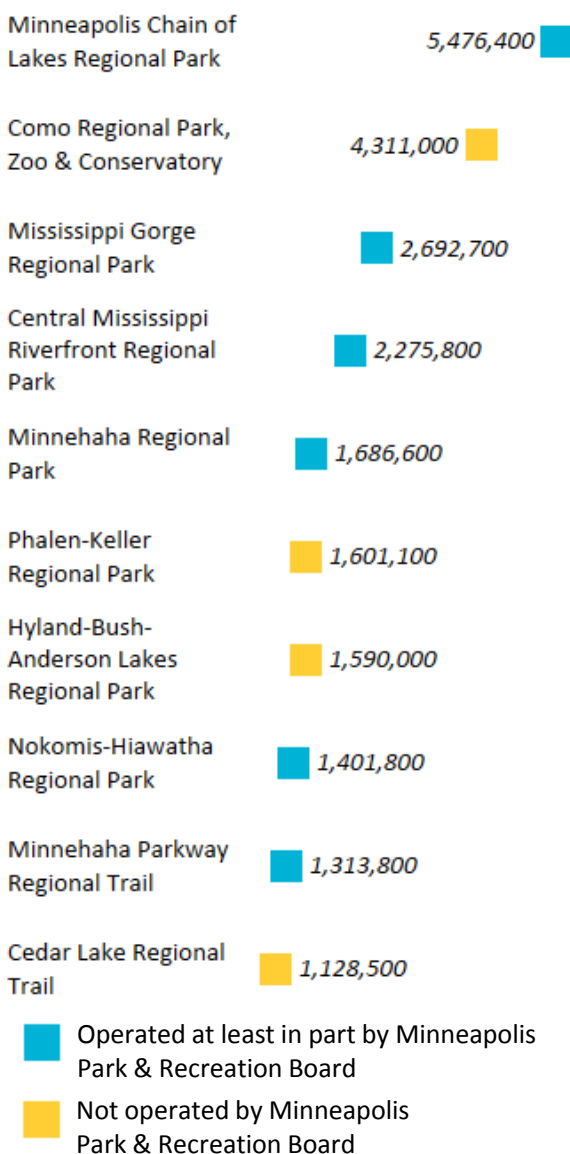
- Rain gardens
- Stormwater ponds
- Bioswales
- Grit chambers
- Green roofs
- Permeable pavers
- Infiltration basins or trenches
- Underground storage devices
- Filter devices

Human use influences water quality, and water quality influences visitor experience. (Are we loving our waterways to death?)

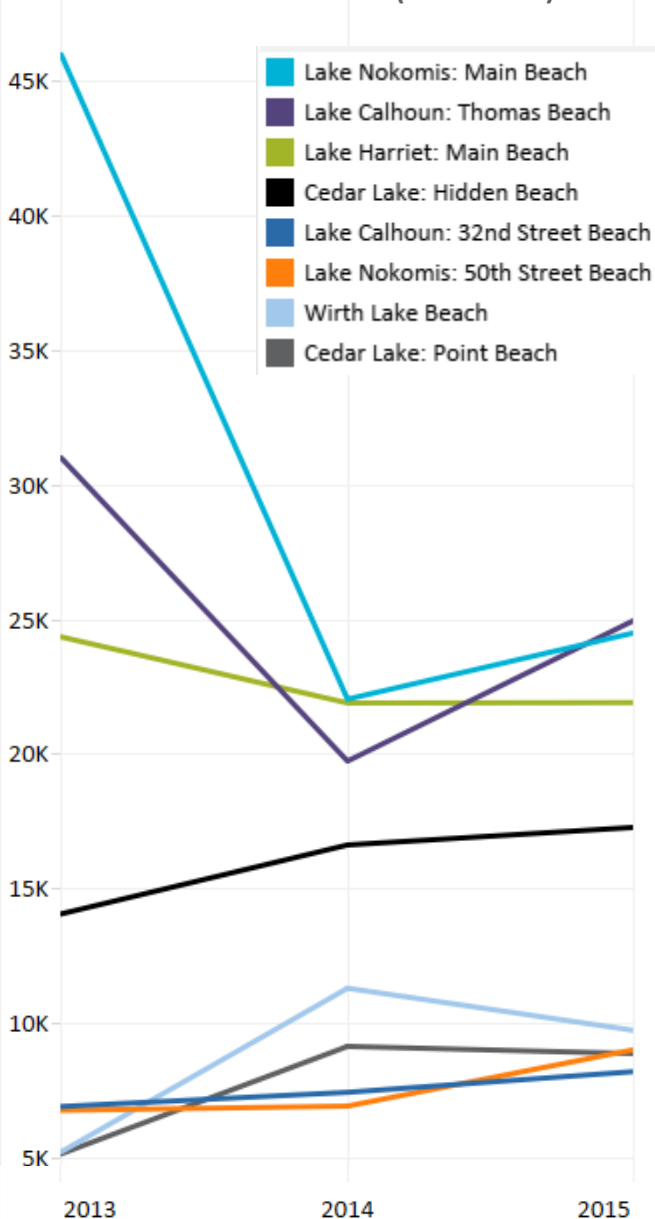
Minneapolis water bodies are cherished assets. Many Minneapolis residents and visitors visit them regularly for recreational purposes including walking, running, biking, swimming, fishing, boating, and relaxing. Human activities impact the quality of Minneapolis water bodies by eroding soil from the shoreline into the water, not cleaning up pet waste, leaving trash, and feeding waterfowl. These impacts also influence human enjoyment of water bodies by contributing to nutrients that fuel algal growth and bacteria that lead to beach closings.

The Minneapolis Chain of Lakes is the most visited regional park/trail in the metropolitan area.¹ Four of the top five most-visited parks/trails are located at least in part on Minneapolis water bodies.

2014 estimated number of visits: Regional parks and trails in metropolitan area¹



Estimated beach attendance (2013-2015)²



1. Data source: Metropolitan Council, <http://www.metrocouncil.org/Parks/Publications-And-Resources/PARK-USE-REPORTS/2014-Annual-Use-Estimate-of-the-Regional-Parks-Sys.aspx>

2. Data source: Minneapolis Park & Recreation Board

Although public perception of water quality is important, the health of lakes, rivers and streams involves much more than can be seen from the shoreline.

Challenge case study: Aquatic invasive species

Aquatic invasive species such as Eurasian water milfoil, zebra mussels, and starry stonewort, threaten native ecosystems and impair water recreation activities. The Minnesota Department of Natural Resources identified preventing the spread of aquatic invasive species as a top priority in their 2009 State Management Plan for Invasive Species. Due to the ongoing threat of new aquatic invasive species invading Minneapolis lakes and creeks, preventing the spread of invasive species is also a top priority for the Minneapolis Park & Recreation Board (MPRB).

Along with ongoing management of Eurasian water milfoil, the MPRB's goal is to delay the introduction of new aquatic invasive species as long as possible in anticipation that techniques are developed to prevent or control their establishment. The MPRB has continued to strengthen prevention efforts including, response planning, increased education, and working with partners such as the sailing community.

Understanding that aquatic invasive species spread most easily via water-related equipment, the MPRB began requiring inspections at all MPRB boat launches in 2012. Aquatic invasive species inspection staff, funded by the MPRB and the Minnehaha Creek Watershed District, supervise boat launches at Harriet, Calhoun, and Nokomis, and educate the public about invasive species management and actions they can take to reduce their spread.

In 2015, MPRB inspectors conducted over 8,500 boat inspections. Trained staff educated boaters and park patrons on aquatic invasive species transport laws, harmful effects of aquatic invasive species, and ways to reduce the risk of an infestation.

Managing aquatic invasive species is an ongoing water quality challenge that will remain in the future. Continued education and outreach can help promote actions that minimize the spread of these detrimental species.



healthy lakes, rivers and streams

**FUTURE IMPROVEMENTS IN WATER QUALITY
WILL REQUIRE ACTION TO BE TAKEN BY THE CITY,
BY ITS BUSINESSES AND BY ITS RESIDENTS.**

This means planning for emerging but currently unregulated pollutants, and thinking creatively about how to educate the public and City employees about issues that might impact our water. Future impacts are influenced by regulations. The future is also determined by our ability to take action as an enterprise, city, state and world.

Being aware of non-regulated sources is important as we think about future actions to take.

Challenge Case Study: Contaminants of emerging concern (Pharmaceuticals and personal care products)

Scientists are studying and measuring how pharmaceutical compounds (like prescription drugs) and personal care products end up in our water bodies. There are not yet water quality standards for pharmaceuticals and personal care products, and concentrations of these chemicals are not regularly measured or evaluated in the same way that other pollutants are measured in the water impairments process. The City of Minneapolis is a partner with the Minnesota Pollution Control Agency for a pilot to monitor these chemical types in stormwater runoff.

There are also no standards in place for the amount that can be released by wastewater treatment systems. Wastewater treatment technology is currently not able to filter out many of these chemicals. (Wastewater treatment plants are operated at a regional level, not controlled by the City of Minneapolis.)

Minneapolis residents can help by considering their use and choices of personal care products and correctly disposing of pharmaceuticals. The City can take a more active role in communicating the appropriate disposal of pharmaceuticals.

Proper disposal is important!

- Medicines flushed down the drain or disposed of in the trash can contaminate water, harm wildlife and pollute drinking water.

Get rid of your medicines

www.hennepin.us/medicine



**Drop boxes for medicines are provided throughout Hennepin County.
In Minneapolis the drop box is in the lobby of the county's Public Safety Facility,
401 4th Avenue South (across the street from City Hall).
It is open 24 hours a day, 7 days a week.**

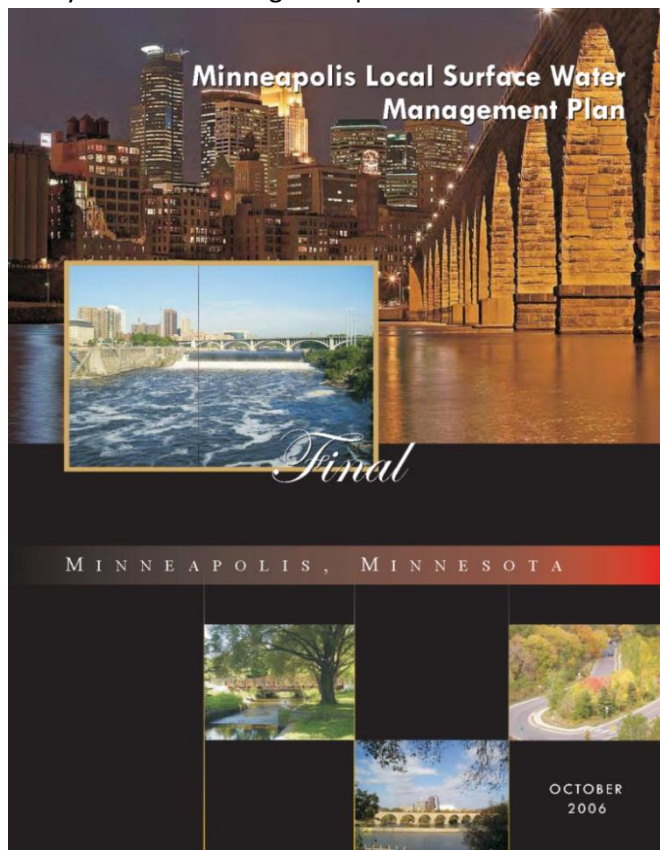
Adapted from Hennepin County website

City responsibilities include long-range planning to make sure that water quality is considered in City decisions.

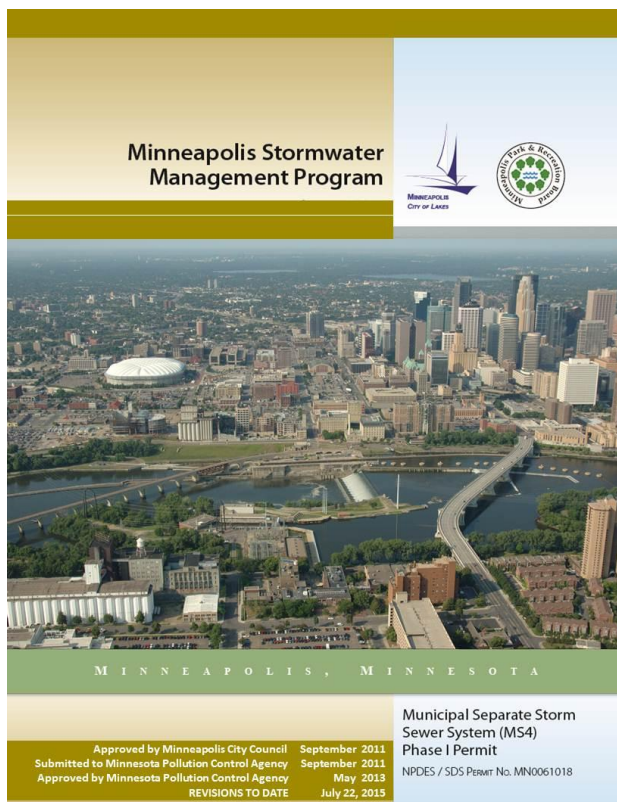
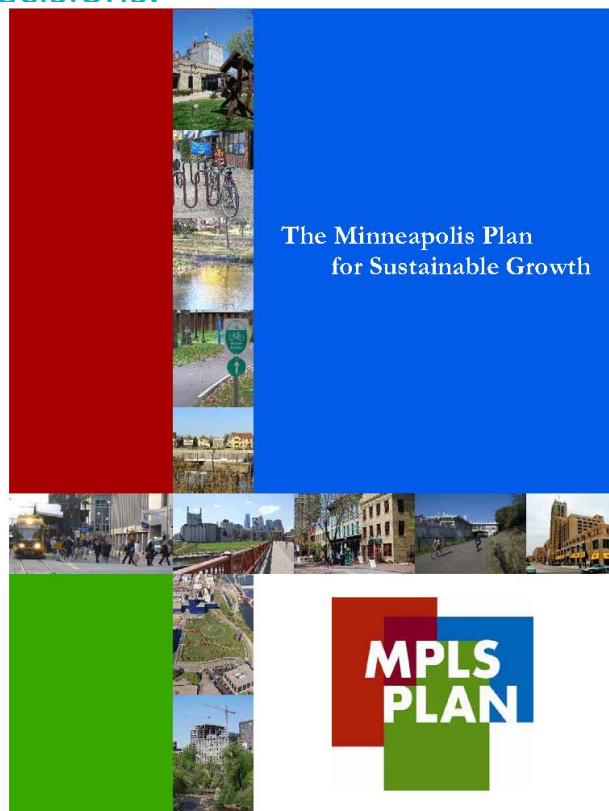
The City's Comprehensive Plan is a 30-year vision for Minneapolis updated every ten years. The 2009 edition is called The Minneapolis Plan for Sustainable Growth. The 2019 update will include guidance and policy recommendations related to protection of our lakes, river and streams.



The comprehensive planning process also requires the City to provide ten-year updates to the Local Surface Water Management Plan that guides the City's work to manage and protect its water bodies.



The City also prepares and carries out a Stormwater Management Program. The document contains background and general information, and detailed descriptions of stormwater management practices and programs under the federal Clean Water Act.



Education is critical because improving water quality requires action by City staff, businesses, and residents.

Community engagement and public education is essential for behavior change to protect our lakes, river and streams. The City and Park Board engage in many programs to promote awareness and action. Several are highlighted in this report.

Public education focus: family events

Hands-on water quality educational displays focus on neighborhood watersheds and how human activities impact local water bodies. Environmental Education staff at the Minneapolis Park & Recreation Board utilize a variety of methods to provide water quality education at events. Methods include a portable water quality focused mini-golf course, a large scale floor graphic with a map of Minneapolis and its watersheds, suitcase pop-up displays in English & Spanish, hand-outs, and one-on-one discussions.

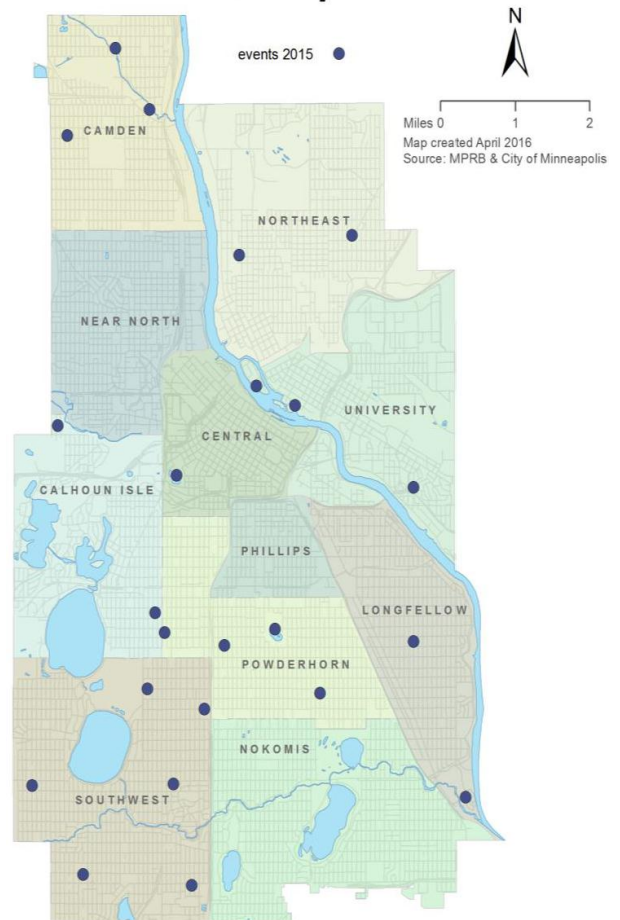
Topics focus on sharing general knowledge of water quality, watersheds, and stormwater runoff as well as encouraging people to take action to improve water quality, such as using less salt or raking up leaves and grass clippings. Some locations and events are one-time occurrences, while others include multiple presentations at concert locations including Minnehaha Park, Father Hennepin Bluffs Park, Bryant Square or Lake Harriet.

The types of groups that engage in water quality education in this format vary, though adults are the primary audience. For example, when youth stop and play the mini-golf course, staff are able to use that time to interact with parents and guardians.



Streets connect to lakes and rivers

Participation: Water quality education sites (many of these sites represent multiple events)



We're all part of the watershed

Education is critical because improving water quality requires action by City staff, businesses, and residents.

Public education focus: youth employment

Mississippi River Green Team

The Green Team is made up of twenty Minneapolis youth ages 14-17 who are engaged in daily hands-on environmental work throughout the summer. One of the Green Team's regular activities is helping to care for the City's stormwater ponds and other water quality sites. The City's vegetation contractors are charged with working with and mentoring the Green Team.

A typical work day includes invasive species removal, weed wrenching, planting, watering, mulching and citizen science work. Second year youth gain leadership experience by helping to train first year crew members. Several students who have moved through the Green Team program have

become interested in environmental careers.

As part of weekly education days and exposure to green career paths, the 2015 crews worked and learned alongside National Park Service Rangers, Minneapolis Park & Recreation Board gardeners, Three Rivers Park District naturalists, Minnesota Conservation Corps members, a public artist, and more. The Mississippi River Green Team is made possible through a partnership between the Minneapolis Park & Recreation Board and the Mississippi Watershed Management Organization, with additional funding through the City of Minneapolis STEP-UP Youth Employment Program.



Greening Teen Teamworks

The Minneapolis Park & Recreation Board manages an annual summer youth employment program for 250 to 300 youth, which is called Teen Teamworks. Crews are assigned to individual parks in Minneapolis and help keep the parks clean. As part of the Greening Teen Teamworks program, MPRB Environmental Education staff work weekly with each teen crew to help them learn about stormwater runoff, water quality, and actions that should be taken to help keep our waterways healthy. Crews are also charged with keeping the park's storm drains clear and curblines picked up, and at parks with waterbodies, the crews remove debris from outlets and tidy up shorelines.

Hands-on learning activities include canoeing, water quality sampling, and macroinvertebrate studies. Teen crews must also create projects that demonstrate what they've learned about water quality; these projects have included posters, small exhibits, photo collages, short videos, and even a song. Results from pre- and post-knowledge tests show that teens and supervisors increase their knowledge and understanding of water quality, watersheds, runoff, and positive actions that benefit our lakes, creeks, and river. The program is funded by the Mississippi Watershed Management Organization.

Education is critical because improving water quality requires action by City staff, businesses, and residents.

Public education focus: resident actions

Residential Raingardens: Property owners build and care for gardens that help minimize pollutants, rate and volume of stormwater runoff, while also adding benefit for pollinators and other wildlife.



Adopt-A-Drain Program: Residents sweep up and dispose of trash, leaves and other materials before rain washes them into the storm drain system. If residents notice the catch basins are plugged, they call 311 to dispatch a maintenance crew.



Canines for Clean Water: Pet owners agree to pick up pet waste, keeping it out of our waterways.



Yuck.

Do you realize where that abandoned dog poop ends up? I drink out of this lake.

One of a new series of posters for the Minneapolis Canines For Clean Water Campaign.

The caption says:
Do you realize where that abandoned dog poop ends up? I drink out of this lake.

Dog poop contains MILLIONS of e.coli bacteria and directly affects water quality in lakes, streams and the river when not disposed of properly. There are more than 100,000 dogs living in Minneapolis creating more than 41,000 pounds of solid waste each day. Be responsible and do your part to help keep our water clean and safe.

scoop the poop. CANINES FOR CLEAN WATER

healthy lakes, rivers and streams

APPENDIX

Rubrics for scoring each individual component of the LAURI

Table 1-5. Scoring for the public health portion of LAURI.

<i>E. coli</i> bacteria, (MPN/100mL) *	Score
<2 (Not Detected)	10
2 - 10	9
11 - 20	8
21 - 35	7
36 - 50	6
51 - 65	5
66 - 80	4
81 - 100	3
101 - 125	2
>126	1

* The value used is the running geometric mean for the year, averaged for all the beaches on a lake.

Table 1-6. Scoring for the water quality portion of LAURI.

Secchi Depth (m)	Deep Lake Score	Shallow Lake Score
0 - 0.5	1	2
0.6 - 1	2	4
1.1 - 1.5	3	6
1.6 - 2.0	4	8
2.1 - 2.5	5	10
2.6 - 3.0	6	
3.1 - 3.5	7	
3.6 - 4.0	8	
4.1 - 4.5	9	
> 4.6	10	

Table 1-7. Scoring for the habitat portion of LAURI.

Macrophyte species	Score	Density	Score	Coverage >15 ft.	Score	# Fish species	Score
0	0	Low	0	0-25	2	≤6	2
1-2	3	Low-med	3	25-50	4	7-8	4
2-4	6	Medium	6	50-75	7	9-11	6
5-6	8	Med-high	8	75-100	10	12-14	8
> 6	10	High	10			≥15	10

Rubrics for scoring each individual component of the LAURI

Table 1-8. Scoring for the recreational access portion of LAURI.


















Recreational Op	#	Total # Ops + Aq Plnt Mgmt	Score
Fishing Dock		0	1
Beach		1	2
Boat Landing		2	3
Boat rental		3	4
Boat storage		4	5
Picnic area		5	6
Concessions		6	7
Aquatic Mgmt = yes	+ 4	7 - 8	8
Aquatic Mgmt = no	+ 0	8 - 9	9
TOTAL		> 10	10



Table 1-9. Scoring for the aesthetic portion of LAURI.

Color	Score	Odor	Score	Debris	Score
Clear	10	None/Natural	10	None	10
lt. Brown or green	8	Musty - faint	8	Natural	9
Bright Green	5	Musty - strong	6	Foam	8
Milky White	4	Sewage/fishy/ garbage - faint	5	Piles of milfoil (>3)	7
Brown/Reddish/ Purple	2	Sewage/fishy/ garbage - strong	2	Trash: fixed (>3)	4
Gray/Black	0	Anaerobic/septic	0	Trash: floating (>3)	3
				Many dead fish (>5)	2
				Green scum	2
				Oil film	1
				Sewage Solids	0

2014 estimated visits to regional parks and regional trails

2014 estimated number of visits: Regional parks and regional trails operated by Minneapolis Park & Recreation Board¹

Minneapolis Chain-of-Lakes RP		5,476,400
Central Mississippi Riverfront RP		2,275,800
Minnehaha RP		1,688,200
Nokomis-Hiawatha RP		1,401,800
Minnehaha Parkway RT		1,313,800
Mississippi Gorge RP		1,132,100
Victory (Wirth) Memorial Parkway RT		650,300
Kenilworth RT		634,000
Theodore Wirth RP		583,500
Cedar Lake RT		467,500
North Mississippi RP		266,000
St. Anthony Parkway RT		224,400
Northeast Diagonal RT		179,900
Shingle Creek RT		134,800
Luce Line RT		132,900
Columbia Parkway RT		80,100
Ridgeway Parkway RT		21,400

 Regional park (RP)  Regional trail (RT)

1. Data source: Metropolitan Council, <http://www.metrocouncil.org/Parks/Publications-And-Resources/PARK-USE-REPORTS/2014-Annual-Use-Estimate-of-the-Regional-Parks-Sys.aspx>